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The Milling Machine—Its Construction and Uses.

SIXTH PAPER.

By John J. Grant.

One of the most annoying jobs on a planer, and one that uses up the most time with the least amount of work to show for it, is planing slots or bolt-head channels. More especially is this true if the slot runs only part-way through the piece. In this case it is necessary to fasten the apron containing the tool clamp down solid, also to screw all the gibs tightly, and if the workman succeeds in finishing such a job without breaking at least one of the hook tools used for the purpose, he breathes freely. Slots of this description can be milled out in less time than it takes to plane them; they will be nearer to the gauge, smoother, and in fact better in every way.

The tools for this operation are simple and very easy to make, and will last for a long time. The cutters are called shank cutters, the ends being made to fit sockets. I would advocate the use of sockets or collets with a straight hole. A set of sockets with holes of the following sizes and depth will be very handy:

Hole $\frac{1}{4}''$ diameter by $1\frac{1}{4}''$ deep.
" $\frac{3}{8}''$ " " $1\frac{1}{2}''$ "
" $\frac{1}{2}''$ " " $1\frac{3}{4}''$ "
" $\frac{5}{8}''$ " " $2''$ "
" $\frac{3}{4}''$ " " $2\frac{1}{2}''$ "

These holes should, of course, be prefectly true. It will be no trouble to make them so if the center hole of the spindle is right. If this does not run true, the best way is to fit the socket to the spindle, chuck the hole $\frac{1}{32}''$ too small, and finish it in place, by fastening a slide rest to the carriage or platen of the machine and boring it out.

The reasons for using the straight shank cutters are: First, the cutters are not as liable to work out when in use, they being firmly held by a set screw. The larger surface of the taper on the collet will, as a general thing, prevent that from coming out, but if made in the manner alluded to in a former paper, no danger from even the collet becoming loose need be apprehended. Second, they can be fitted in about one-half the time that is used in fitting the taper shank; also they require less stock. Third and last, they can be changed quicker than the taper shank cutters, and set in or out a little, making it unnecessary to disturb the adjustment of the table when once set. The advantages of the straight shank cutter for this style of work will, I think, be appreciated when used.

To make a perfect T slot it is necessary to take four cuts; the first with a straight cutter of a diameter from $\frac{1}{32}''$ to $\frac{1}{16}''$ less than the width of the narrow part of the slot when finished, as represented in Fig. 1. Dotted lines show the finished slot. This cutter should leave $\frac{1}{16}''$ on the bottom for the T cutters to finish.

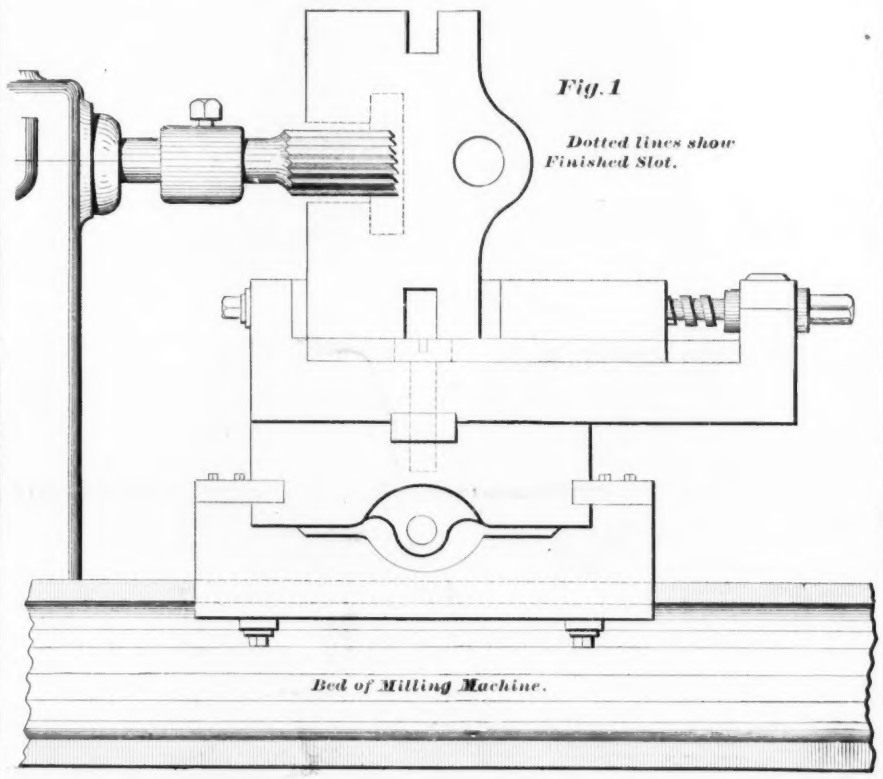
A cutter made with a plain shank, that is, with no cut on it, the shank being made as large as possible to pass through the slot made by the previous cut, and having a cutter of a diameter and thickness $\frac{1}{16}''$ less than the finished slot should then be passed through, (see engraving Fig. 1). The slot is then ready for the finishing cutter. The shank of this should be made into a cutter, and of a diameter of about $\frac{1}{32}''$ less than the finished size of the slot. This should be set to take one-half of the chip or cut necessary to bring the slot to the gauge. Before running the table back it should be adjusted to take the finishing cut, which should be done by feeding the table *backwards*. As milling machines are now made this can only be accomplished by having both straight and cross belts.

When a T slot is to be milled that is not required to be gauged, perfectly, the finishing cutter can be made to full size of slot, and passed through at one operation. Where the work is cast-iron, and of such a nature that a core can be set to make the slot of T shape, it will then be necessary to have only two cutters. In this case both shanks should be made to cut. The heads of all such cutters should be cut on both faces as well as on the periphery, and screwed upon the shanks. A coarse, shallow square thread should be used, and the holes in both roughing and finishing cutters should be of the same size.

When the finishing cutters become too dull to perform good work, they can be ground to the roughing size. After the first cost, the expense of keeping the tool in order for this job will not be as much as for the planer tools for the same work.

In milling T slots the spindle must work as close in the bearings as possible, and all end chase taken out; also have the traversing table work as snugly as it will, to prevent the cutter from jumping into the work.

In the next paper I will give drawings and explanations of a very good arrangement for milling bevels and pieces that require to be gibbed. The fixture has been in use several years, and has paid for itself a hundred times over.



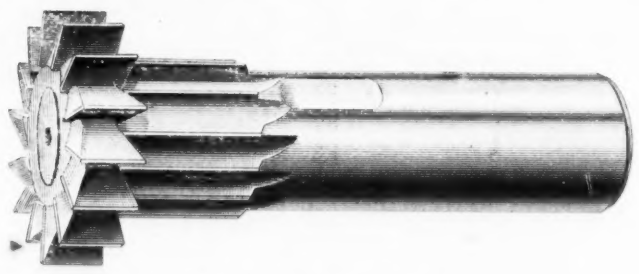


Fig. 2.—Finishing Cutter.

Extracts from Chordal's Letters.

VALUE OF BOOKS AS INSTRUCTORS IN A VOCATION—SKILL AND THE KNOWLEDGE OF SKILL—KNOWING THINGS WITHOUT BEING ABLE TO TELL WHY—LEARNING THE ART OF DRAUGHTING—ACCURACY NOT GAINED BY INSTRUCTION—SEPARATE FUNCTIONS OF KNOWLEDGE AND SKILL—HOW TO BEGIN LEARNING TO DRAW—VALUE OF A MODEL TO COPY.

Mr. Editor:

* * * There is a division of opinion upon the subject of the relation which books bear to the acquirement of proficiency in a vocation. One class believes that the books will not do any good at all, and that he who is skilled, or versed, is less skilled or versed by reason of his knowledge of the books. Another class believes that you cannot get along at all without the books, and that no one can be skilled or versed who has not been through the books. It is pretty hard to get the straight of the thing, as the subject-matter of the skill has much to do with the question. Often I notice in the query columns of the mechanical journals some green-horn asking what books to get to learn to become a locomotive engineer. It might reasonably be supposed that a person asking such a question had already acquired the hand and thumb part of the business, and by "learning to become an engineer" he meant to improve himself in the science of the thing, but the very question, viewed in the light of an acquaintanceship with men having the hand and thumb of the business gives itself away. No man who has ever engineered any on a locomotive will deliberately put himself upon record by asking for anything which will teach him to become an engineer. It is always safe to presume that the questioner has not taken the first step toward the acquirement of the art he covets. One of the classes above referred to would say the man is right in asking for the books, and that he never can learn to be an engineer without them. The other class would say if he wants to become an engineer he don't want any books

* * * Many men have become locomotive engineers without the aid of the books, and they have become good ones. I question whether a single example can be shown of a man who became an engineer—or anything else so far as that is concerned—by means of the books. As to the actual value of the books in improving a man who has acquired a vocation; as to the actual degree of the desirability of the books; as to the necessity and desirability of them at all, I for one am silent. Some vocations involve skill and absolutely nothing but skill; as for instance the art of handling a file so as to get something flat. But locomotive engineering is not a question purely of skill—that is, of manual skill. I question whether an old locomotive engineer grasps a reversing lever with any more skill, after fifty years of experience, than he did the first time he took hold of it. He does not move it with any more skill after he does grasp it, but he learns when to move it and when not to move it, and he has acquired, or was born with, that peculiar something which endows him with the power to grasp it at exactly the time when his knowledge of things tells him that he should do so. This is not skill. I do not know what it is. It is not the skill which ties the knot which sustains the weight; but it is that something or other which enables a man to walk from under the falling weight when the knot is slipped. Some people will stay and get mashed when their knowledge of things tells them to go. This presence of mind, this nerve, this coolness which goes so much to make up some of the every-day avocations of life, what is it? Is it skill or is it akin to skill; is it habit, or familiarity, or courage, or what? What word of mouth, what civil service examination, what longer or shorter catechism will determine upon the degree of this peculiar something which is possessed by the person being examined?

Q.—What would you do in case a boiler began to blow steam through the seams?

A.—Draw the fires and open the safety valve.

* * * *Q.*—What did the man do when the boiler began to blow the steam through its joints?

A.—Stood transfixed and yelled like an Indian, too much scared to run.

* * * In handiwork there are two elements

skill and the knowledge of skill. Thus in hand-turning the knowledge of skill tells us that a certain kind of chattering proceeds from a certain peculiar handling of the tool. Skill shifts the tool around properly and the chattering stops. Probably the exercise of skill in holding the tool properly cannot be described, and if it could, he who was the most skillful would probably be the most, or the least, adapted to describe it. You see a man filing something rounding; you take his file and file it flat. He asks you how you did it. You answer that you do it but do not know how you do it. I do not believe that any man knows how he files flat. There are lots of things the skillful do which have no "how" or "wherefore" to them that can be got out of them.

The witness on the stand said, "I know it to be so;" and the attorney, on cross-examination, said, "On your oath, how do you know it to be so?" and the witness said, "On my oath, I do not know how I know it to be so."

A man may know lots of things without knowing anything about how he knows them. There are many elements of manual skill, only a portion of which may be stated in descriptive terms.

* * * When one man wants to learn draughting, the first thing he begins to inquire about is some book out of which to learn draughting. When some other man wants to learn draughting, he goes at it and draughts, and the going at it and the keeping at it constitutes the learning. All the books under heaven will not stuff a man so full of knowledge that he can say that he is a draughtsman before he has commenced to draw. If it was a question of books, all he would need to do would be to acquire all of the knowledge that is in them. I am a sort of a draughtsman myself, and I give it as my honest opinion that books on draughting should be read only by draughtsmen, and not by people who wish to become draughtsmen. These books should be entitled, not "Information for People Desiring to Learn to Draw," but "Information for Draughtsmen."

In my opinion, the art of draughting is one of those things which, so far as the art itself is concerned—that is, the skill of it and the practice of it—will force itself upon a person. He will draw in spite of himself if there is any earthly necessity for his drawing. If the necessity and the honest desire arises, he will draw, and draw, and draw. He becomes a draughtsman—maybe a good one, maybe a poor one—and the books will do him good in either case. He needs the books to improve himself as a draughtsman, but I hardly think that he needs them to initiate himself as a draughtsman. I draw a broad distinction between the geometry of the art and the art itself—between the perfectly drawn line and a comprehension of what the line means. He who is up in the science of lines and figures and bodies is a scientific draughtsman, but he is no more a draughtsman than he who knows nothing of them. The skill to delineate the creeping spider or the ugly lathe leg has nothing whatever to do with the laws of natural history, or the laws of the strength of material. A draughtsman may be more useful from a knowledge of the strength of material precisely the same as he may be more useful by reason of being versed in natural history. When I speak of the art of draughting, I mean the art pure and simple of delineation, not of design or of mechanical analysis or of comprehension of the thing delineated.

* * * The working machinist at home at nights, without hint or instruction, with bad paper, bad light and worthless instruments, makes a drawing of some common piece of machinery. He shows it to a draughtsman, and asks instructions. The drawing proves to be inaccurate in its dimensions. This is not owing to the man's lack of skill as a draughtsman, but to his lack of accuracy as a man. All the professional draughtsman can tell him is, "You are not accurate in your work." Whether the man may become accurate by habit or not, depends upon, largely, the man himself. If we can imagine that he was so wrapped up in the mechanical execution of his drawing as to be somewhat rattled upon his measurements, we may presume that accuracy will come with practice; it can never come through instruction. The draughtsman sees in the tyro's drawing that the circles do not join the straight lines nicely. The tyro can see this as well as the draughtsman. He need not instruct the tyro in the art of making proper junctures; but if he call his attention to the matter, the tyro will correct them himself. This is somewhat different from the matter of inaccuracy of dimension. Ten chances to one this tyro had never formed an idea of what neatness or accuracy in drawing was. Instruction might post him on this, but not a bit better than a model, or something to be looked upon as a standard; or if the man has pride and ambition, something to be looked upon as a standard to be improved.

KENT'S RIVETING MACHINE.

One class of skillful men detect their own shortcomings as they go along. They make their own standard. Their standard is simply the best they can do, and such men usually do a great deal better than would be indicated by any standard to work by, or any instructions to work from. We find the tyro fairly proficient in the skill of making pleasing drawings, showing smoothness, and, we may say, perfection of skillful execution: but a man of sense, be he draughtsman or no draughtsman, looks at them and detects at once that they fail to show what ought to be shown; they fail in the principal intention of a drawing. This sends the tyro back to the question of knowledge. He must acquire a knowledge of disposition of views; he must learn of the merit of the section; he must cultivate common sense, which tells when a section is needed, and where to make a section. This has nothing to do with skill in draughting. This pertains to the knowledge of draughting. He must learn of the use of dotted lines which expose to view the invisible. Knowledge knows of the use of the dotted lines; skill knows how to produce them.

* * * If I were called upon to instruct in drawing, I would say to the student, "Go at it and draw something, and when you have it done, take it to some one who knows no more about the matter than you do, and ask him if it explains to him fully the thing which is drawn, and whether he can criticize the manual execution of the drawing. Apply good common sense to his criticisms, so as to avoid them in the next attempt. Do not attempt to meet the criticisms by argument, but meet them entirely by improved execution."

* * * In the ancient machine times—a very few years ago, by-the-by—the limited amount of clay developed so very few hard-headed constructors that those few became famous, and thus we find enrolled upon the scroll of honor the names of Maudsley, Nasmyth, Clement and Whitworth, and probably a dozen others, who were lords of art in their day—bright lights in the darkness. The mechanical world to-day is thronged with men their equal in every way, but the brightness of the light is not apparent for obvious reasons.

* * * The names of these worthies are brought to my mind by a question in drawing brought to light in the biography of Joseph Clement. I quote:

"While working at Glasgow as a turner he took lessons from Peter Nicholson, the well-known writer on carpentry, a highly ingenious man. Nicholson happened to call at the shop at which Clement worked in order to make a drawing of a power loom, and Clements' expressions of admiration at his expertness were so enthusiastic that Nicholson, pleased with the youth's praise, asked if he could be of service to him in any way. Emboldened by the offer, Clement requested, as the greatest favor he could confer upon him, to have the loan of the drawing he had just made in order that he might copy it. The request was at once complied with, and Clement, though very poor at the time and scarcely able to buy candles for the long winter evenings, sat up late every night until he had finished it. Though the first drawing he had ever made, he handed it back to Nicholson, instead of the original, and at first the draughtsman did not recognize that the drawing was not his own."

In my opinion, Mr. Clement—providing, of course, this story be true—needed no drawing instructions from Mr. Nicholson, and I expect all that he ever got was simply that peculiar sort of a patronage that comes from a fancied superiority in art. As a matter of fact, in this connection, Clement became one of the most famous mechanical draughtsmen in the world, but I think all that Nicholson had to do with it was to furnish him a model for his first drawing. He may possibly have gone further, and by exposing to Clement his finest works aroused the pride of skill, and urged the student to do his best, which best turned out to be a great deal the better.

* * * In connection with learning to draw, I will never cease to enlarge upon the value of a model to draw from—a sample drawing, I mean—to be copied or improved upon. The objection to all the books lies in the imperfection of the sample work which is furnished. These samples consist generally either of elegant, finely-executed plate printing, or of wood-cuts, either crude or fine, and they are not adapted in any degree to serve as models for draughtsmen who seek to acquire the skill to make good ink drawings. Really, I do not think that any manner of engraving will produce the proper stimulus for the student in drawing. He knows to start on that he cannot produce a *fac-simile* of the thing he models after, and how is he to know where to stop the line of comparison? Give him a real drawing as a model; he need never stop comparing. He need not seek an approach; he must strive after an identity or an improvement. He can never hope for either when working after an engraved model. The flow of ink from the drawing pen produces a peculiar line. A failure in the characteristics of this line constitutes a lack of skill in draughting. It is not to be compared in any way with any form of printed line.

Very respectfully,

CHORDAL.

Kent's Riveting Machine.

To meet the growing demand for the application of power in boiler-making operations, the machine shown on this page has been put upon the market. Accurate tests to show the strength of riveted seams done by various methods have demonstrated that a good riveting machine does more reliable work than can be performed by the slow hand methods. This fact is making machine riveting daily more popular, and the demand for machines to do the work is consequently increasing. The gap in this machine is five feet six inches long so that it will operate on the seams of a boiler eleven feet long. The machine is fastened to the floor at any convenient point and the boiler to be operated upon is held by any suitable means. Power is applied by a belt to the pulley shown, which operates a worm connecting with riveting die. The wheel on top of the machine regulates the travel of the die, and can be graduated from 3½ inches down to nothing. The force of the blow can be conveniently regulated by the operator. The machine is started and stopped by a foot lever shown in the engraving. When necessary the machine can be used for punching by changing the riveting dies for a punch. These machines are made by Robert Kent, 45 Jay street, Brooklyn, N. Y.

Steam Boiler Defects, Water-Gauges and Gauge-Cocks.

The Inspector's Reports of the Hartford Boiler Insurance Company for July, just published in the *Locomotive*, show that 4,567 boilers were visited. Of these 2,171 were inspected internally, and 405 by hydrostatic pressure. The number of defects found was 3,563, of which 662 were considered dangerous. In looking over this table of defects we notice that cases of deposit of sediment and cases of incrustation and scale sum up about one-third of the whole number of defects. Blistered plates come next in number, followed by leaky tubes, defective riveting,

defective pressure gauges, external corrosion, and leaky seams. Not one of the boilers was found without a pressure gauge.

As an addition to this report the company says:

"The *water-gauge* is one of the most important fixtures pertaining to a steam boiler, and upon its indications the safety of the boiler in a great measure depends. Therefore it behooves the engineer and steam-user to look sharply to its condition at all times, and see that it is in proper order, and that its indications show the true level of water in the boiler."

"Probably the most reliable of all the different forms of apparatus that have been devised for showing the height of water in steam boilers is the ordinary gauge cock, properly located and kept clean. The glass gauge is a valuable adjunct in the hands of a careful man, but as ordinarily constructed is very apt to become stopped up, unless the water is more than ordinarily pure, and then, if too much reliance is placed upon it, its indications are not only useless, but absolutely dangerous. Many accidents that have occurred have undoubtedly been due to the passages to the glass having become filled up with sediment, so that the water-level indicated by the glass was not that of the water in the boiler. When a glass water-gauge is used, more especially when it is placed with the gauge cocks on a column, or "combination," as it is usually called, it should be thoroughly blown out at least three times every day. Merely opening the drip-cock at the bottom of the glass connection for a few seconds is not enough. Remember that there are *two* passages to the glass, *both* of which must be kept clean to give the glass any value as a water-gauge. When the glass is to be blown out, close the stop valve at its upper end, and blow out the water passage at lower end, then close the stop valve at lower end, and blow out the steam connections. When you have blown out the glass sufficiently, don't forget to open *both valves* and leave them open.

"With a gauge cock it is different. The very act of 'trying' them assists in keeping them clean. The best way to connect them to a boiler is to run each one separately into the boiler straight through the front head. No bends in the pipe should be admitted. If the pipes are straight they may be easily cleaned by running a wire through them, even when steam is on the boiler. The connection should be of good size, not less than $\frac{3}{4}$-inch pipe being used.

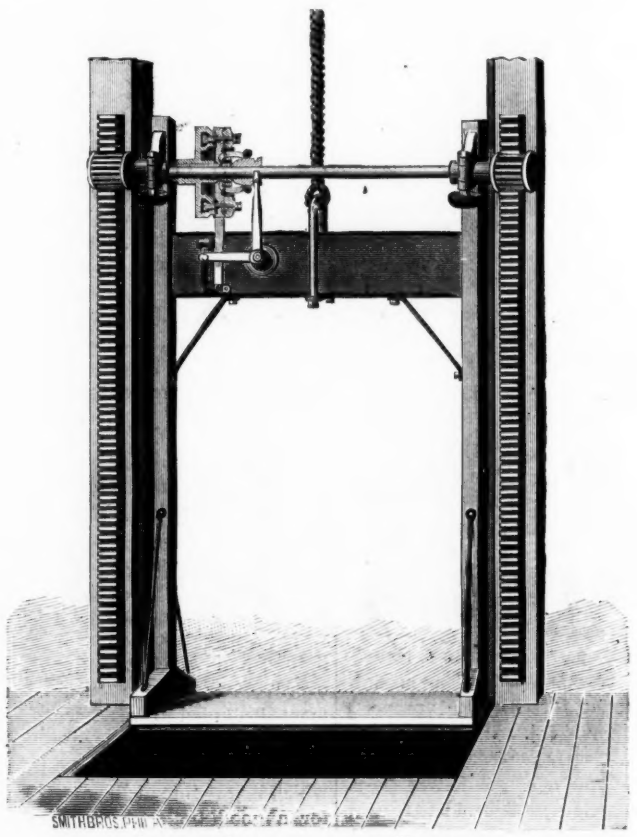
"When the cocks are placed on a column, or combination, the pipes connecting this with the boiler should never be less than $1\frac{1}{4}$ inches in diameter. They are usually made one-half or three-fourths of an inch. Where bends occur in these pipes, tees or crosses should be used, instead of elbows. Then by simply removing the plugs from the tees, the pipes may be easily cleaned out without disconnecting them from the boiler. A half-inch pipe should be run from lower end of water column into the ash-pit. This pipe should be provided with a valve, by opening which the apparatus may be blown out once or twice daily.

"When gauge cocks become worn so that they begin to leak, it is very poor policy to continue them in use. They should be at once repaired or new ones substituted. When it becomes impossible for an engineer or fireman to close a cock after 'trying' the water, he is very apt to try it only when he is obliged to, and very naturally too. The possible risk thus incurred of letting the water get low in the boiler is one that no steam user can afford to take."

A machine for making twist drills has been patented by Francis H. Richards, Springfield, Mass. The blank drill to be operated upon is held by a specially designed spindle, capable of longitudinal and rotary motion. Two spindles, standing at an incline to the axial line of the blank, operate milling cutters, which cut the grooves. The machine looks practicable; and if it works well, there is a place for it in the tool-making shops.

The New England Manufacturers' and Mechanics' Fair, at Boston.

While many leading builders are not represented, still, on the whole, the steam engine exhibits at the fair are good, and attract more attention from visitors interested in machines and machinery than any other single feature. Quite a number of engines are shown doing regular work, which materially adds to the interest. A Ball automatic engine, 9″x12″, running 307 revolutions per minute, and doing probably about 40-horse power work in connection with the Fuller electric lights, is the center of a good deal of attraction, not only from its pleasing design and the quiet manner in which it runs, but from the novel feature involved in its regulation. The diagram from the Moserop speed recorder made by this engine shows practically no variation in speed from change of load, and only a small fraction of one per cent. variation for variations in steam pressure. This engine is exhibited by S. L. Holt & Co., of Boston.



Safety Attachment for Elevators.

A 11½″x20″ Porter-Allen engine exhibited by Gilman W. Brown, of Boston, running at 230 revolutions, driving wood-working machinery, behaves very nicely under extreme variations in load. This is the same engine exhibited last year, but with modifications in the valve gear, by which materially more compression is had in the cylinder. This brings about very smooth running with comparatively loose journals.

The new Westinghouse automatic engine, with cylinder 12″x12″, running at 300 revolutions and driving general machinery, is making a good record. The Westinghouse Machine Company also exhibit a throttling engine, with a Tabor governor. This governor is so constructed that the position of the valve is determined between the centrifugal action of the weight and the counteracting force of a spring, the leverage at which the spring acts being variable. By adjusting the forces (the centrifugal force of the weights and the resisting force of the spring) to that end, the usual effect of running slower as the load is increased, may be reversed, the engine running faster under a heavy load than under a light one.

The Fitchburg Steam Engine Company exhibit a horizontal automatic engine, but unfortunately it is not situated so as to connect with any shafting in the building, the engine running light. A governor, as used with this engine, is on exhibition, which is an example that others exhibiting engines with disk governors would add to the general interest by following. With such engines in motion, it is impossible for the uninitiated to form any reasonable idea of the operation of the governor, but with the governor under inspection its construction can be satisfactorily investigated and its operation made plain.

One firm exhibit a number of engines, two or three of which of considerable size, are occasionally run light, the steam pipes being reduced near the engines to $\frac{1}{8}$ inch. What this is intended to illustrate, unless it is that considerable steam at eighty pounds pressure will pass through a hole about $\frac{3}{16}$″ diameter, it would be hard to tell.

There are two Armington & Sims' engines driving dynamos, but the exhibit with which they are connected is carefully fenced in from close observation. There is but one exhibit of the Corliss type of engine, made by the Swampscot Machine Company, and the West is represented by one exhibit, the Cummer engine, of Cleveland, near which is a neat small Payne automatic engine.

The Wise motor is operated by steam, and so may be classed with steam engines. No particular effort seems to be made to explain the construction and operation of this machine.

It may, in a general way, be said to be a rotary engine without the usual wearing parts. The steam acts in some way against wings or buckets, something as water against the buckets of a water-wheel. These motors are more especially recommended by the inventor for driving blowers and exhaust fans, which, by direct connection, they are shown doing very satisfactorily, but with what economy in the use of steam cannot be inferred. To show that they will work with low pressure of steam, a Curtis pressure regulator is introduced in the steam pipe, and the pressure reduced to 15 or 20 pounds—sometimes lower.

The exhibitors of injectors and inspirators have liberally supplied the exhibition boilers with means of feeding. The Mack and the Korting injectors, and the Hancock inspirator are located on these boilers somewhat promiscuously, giving the fireman the benefit of an extended and liberal choice in the matter of which he will use.

In steam pumps the supply is limited, if two or three rotary pumps and pulsometers are excepted, being confined to a couple of fly-wheel and yoke-pumps by the Southwark Foundry and Machine Company, and a new duplex pump by the Hall Duplex Steam Pump Company, of New York. In this pump the valves are of the piston type, working in steam chests on top of the steam cylinders. Each valve is composed of two pistons on one stem, separated by a considerable space and traveling the full length of the stroke of the pump, being worked direct from the piston rod. The valve of one pump admits steam to the other through cross-ports. Steam pressure is between the two pistons of the valve.

Moulders' tools seldom figure in the list of an industrial exhibition, for which reason the fine exhibit in this line from Charles Monk, of Brooklyn, is particularly noticeable. Apparently about everything required by a moulder is shown in this exhibit, which fills a large show case.

A. J. Wilkinson & Co., of Boston, amongst their really fine exhibit of small tools, embracing nearly everything required by machinists and wood-workers, show complete sets of castings for small engines, not toy engines, but large enough for use in small pleasure yachts, or for other purposes where small power is required.

The Almond coupling for noiselessly transmitting power at any angle is shown in operation from one of the principal shafts in the building. This coupling has been very materially altered in its construction since previously exhibited, but is unfortunately located on a weak wooden post, the spring of which seriously interferes with its operation.

Safety Attachment for Elevators.

The engraving shown with this represents the safety device applied to elevators by D. Frisbie & Co., Philadelphia, Pa. It will be seen that a shaft carries a pinion at each end, which gears with a rack. In connection with this shaft a friction clutch, or cut-off coupling is arranged so that when running at ordinary speed it will be inoperative. When the speed is increased, as by the breaking of the hoisting rope or the gearing, weighted levers operate by centrifugal force to engage the two parts of the clutch, the friction gradually arresting the motion of the car and holding it stationary. The arrangement is simple, with no complicated mechanism likely to get out of order.

We were lately shown through the new machine tool building shop of F. E. Reed, Worcester, Mass. The building is of brick, 180x55 feet, two stories and basement. It is well lighted with large windows. On the first floor a line of Brown & Sharpe work-benches, with iron legs, extends the whole length on both sides. The windows extend below the tops of the benches, so as to light underneath as well as above. Piping runs under the benches for heating with exhaust steam. Two lines of shafting run the whole length of the building. Between these lines runs an overhead traveling crane, capable of picking up and moving two tons with ease. The tool room, in middle of the floor, North side, is 32x18 feet. Plumbing and sanitary arrangements are equal to those of a good dwelling. A 40 H. P. Brown engine, fed by a 60 H. P. boiler, furnishes the power. At one end of this large room is a 20-foot planer, mounted on six stone piers, twelve feet high from the ground. On the second floor are the pattern shop, draughting room, finely-furnished offices, and a large store-room. In the latter will be kept one machine of each kind and size built. The shop is exceptionally well designed and well built.

Two Badly Designed Engines.

The men who design locomotives that are built in railroad shops often get blamed for blundering over the laying out of the valve motion whereby engines are produced that cannot be made to distribute the steam properly. Mistakes of this kind are not confined to draughtsmen of railroad shops. There are two new locomotives in public works in this city that are a curiosity for their inefficiency, and the trouble is all in the valve motion, principally in its design. They are small engines, cylinders 8″x14″ with 40 inch wheels, and weigh ten tons in working order. When the engines were put to work it was found that they would hardly start two cars. An examination disclosed the fact that the valves were set with about $\frac{1}{4}$″ lead, and that the travel of the valve was so short that the ports were within $\frac{3}{16}$″ of being full open when the crank was on the quarter in full gear. Changing the valves to $\frac{1}{16}$″ lead helped the engines to do some work, but they must be operated all the time with the lever close to the corner, otherwise there would be no port opening.

Growth of the Train Brake.

By Angus Sinclair.

HELPLESS CONDITION OF FAST TRAINS IN EARLY RAILROAD DAYS.

Although a velocity equal to the highest speed common with railroad trains of to-day was attained during the first ten years of railroad practice, almost forty years elapsed after railroad locomotion was a pronounced success, before any reliable system was established of bringing trains quickly to a state of rest. Up to the year 1870 the ordinary fast train resembled in a striking manner the Congreve richochet-rocket made famous in the early railway days to illustrate the helpless condition of a fast running train. The power was there to originate the speed, but when a sudden demand arose for stoppage, in too many cases, the only retarding forces available were the natural resistances to the moving mass. In regard to the speed of trains, railroad engineers resembled Ulysses when he released the winds and raised a tempest that he could not subdue.

WANT OF CONTROL LED TO MANY SERIOUS ACCIDENTS.

This condition of helplessness led to many a grievous disaster before the traveling public were educated to demand with the voice of authority, appliances for stopping trains promptly whenever necessary or desirable. And then it was no easy matter to impress railroad managers with the belief, that a good system of brakes could be devised which would do the work of absorbing the speed far more quickly than steam could produce it.

EARLY VALVE MOTION PREVENTED THE LOCOMOTIVES FROM HELPING TO STOP TRAINS.

During the first decade of railroad life, engineers were so much occupied with plans and improvements for increasing the efficiency of the locomotive as an agent of speed and traction, that almost no attention was bestowed upon the means of restraining or controlling the velocity attained. This was all the more surprising, as the locomotive of these times equipped with drop hooks was a peculiarly helpless machine when called upon to aid in stopping the train it had set in motion. With the link motion of later years, the steam could be depended upon by reversed motion to aid in stopping; but the drop-hook nearly always failed to catch when an attempt was made to reverse the motion when the engine was running at any speed, and the V hook was not much better. Yet with this helpless condition of the locomotive, the rude brake that controlled the country wagon was deemed sufficient for holding passenger trains.

FIRST FORM OF TRAIN BRAKE.

A horizontal lever with a bell crank at the end to which was connected a wooden block, was the first form of brake used. When a call for brakes was made, the brakeman dropped the lever out of its notch and stood upon it to increase the pressure upon the wheels. Some early roads were not even so well provided as this with the means of stopping. It is recorded that on a South Carolina railroad for some time after trains began to run regularly, the only means of stopping a train at a station was by all the men round clinging to the cars holding them back, or by pushing pieces of cord-wood between the spokes of the wheels.

IMPROVEMENT BEGUN.

On most roads the hand-lever brake was early displaced by the hand-wheel and chain for passenger equipment, an improvement which rapidly became the recognized method of stopping trains. When the four-wheel truck first came into use, the brake attachment consisted of four vertical wooden blocks, two of which were hung between each pair of wheels, and were applied by a canting bar fastened between the blocks and operated by a lever connected with the chain. The wooden blocks were lined with leather which endured the rubbing wear of the wheels better than the wood, besides being easily renewed when worn. This crude rig was superseded before 1840 by the common freight car brake of 1883, which has experienced remarkably few improvements since it was invented. Wooden blocks have been exchanged for iron shoes, and the working parts have been made a little stronger. Where power is applied to the brake, some complication of levers has been introduced to equalize the pressure, but the brake is essentially the same as it was in 1840.

THE COMMON HAND-BRAKE.

The common car brake had points about it which gave strong recommendations in the eyes of railroad men. It was simple and tolerably efficient for slow speeds, and it rarely got out of repair, while every part about it was easily reached, and any man could understand it. By degrees it worked into universal favor not only with railroad men but also with the traveling public. By the time trains became heavier and the common speed too high for safe control by any hand-brake, this brake had become time-honored, and it is always a difficult matter superseding a time-honored institution however long it may have outlived its usefulness.

IMPORTANCE ATTACHED TO BRAKES IN AMERICA.

In operating American railroads, the brake has always been the most important factor in securing the safety of trains. The roads are mostly single tracks, steep gradients are numerous, there are no signals to protect stations or level railroad crossings; at the same time stations and crossings are located with utter disregard of safe natural approaches, round a curve on a steep descending grade, in a cutting with trees and brush all round, being a common position to find a station or the crossing of another railroad.

IMMUNITY FROM ACCIDENTS OF THE FIRST RAILROAD DECADE.

The first ten years of railroad life were remarkably free from serious accidents resulting in loss of life. This permitted the crude methods of operating to be accepted as satisfactory. Had any of the terribly fatal accidents which happened later through defective brakes and want of signals taken place in the first five years of train service, the probability is that operating appliances would have been improved, so that much subsequent destruction of life and property would have been avoided. What were really reckless practices, were regarded as ordinary concomitants of the new method of transportation. Recurring fatal accidents were needed to convince the public that the hand-brake was not perfect. The grim missionaries, Disaster and Death, went the rounds of railroad trains with appalling frequency before the first American locomotive was twenty years old, and inventors were called upon to provide better means for controlling trains.

BUMPER BRAKES.

Ever since the need of a brake superior to the hand-brake became recognized, those possessing the highest mechanical talent of the country have labored to produce a brake whereby the whole train would be automatically subjected to retarding action. The first attempts in this line were made to devise means of operating the brakes from the crowding together of the cars. This class of brakes are known as bumper brakes, and the crop of patents for devices of this kind has been remarkably fertile. It began to grow about 1845, and the harvest is not yet over. No bumper brake came into practical use in the days when an improvement on the single hand-brake was urgently needed.

CONNECTING THE BRAKES ON BOTH TRUCKS.

The first real improvement effected on the hand-brake was the connecting of the brake on both trucks, so that the hand-wheel at one end of a car applied the brake to both trucks. By means of this invention a brakeman could apply brakes to four trucks without having to move except from one platform to another. It almost doubled the work that one brakeman could do. The credit of this invention is no doubt due to Willard J. Nicholls, car-shop foreman of the Hartford & New Haven Railroad. He did not patent his invention and others appropriated its valuable features, passing it through the patent offices as their own. The invention drew many thousands of dollars from railroad companies, but none of the money went into the pockets of the real inventor. The Tanner brake of litigious memory appropriated the Nicholls invention entire. The Hodge and the Stevens brakes each were arranged to apply the brakes on both trucks from one end of the car; but neither of the inventors claimed that as the object of their patent. Their patents were obtained for certain arrangements of the rods and levers used in transmitting the power applied. Hodge received the patent for his brake in 1849, and his leading idea seemed to be the simplifying of the connections. When the Stevens brake was patented in 1851, the inventor claimed that by the arrangement of rods and levers, each wheel in both car trucks received a uniformly retarding force. This was the first claim for equalizing the pressure on brake shoes. Both these brakes proved highly successful. Within a few years one or the other of them was applied on nearly all passenger train equipment, and to the double trucked cabooses belonging to freight trains. And to-day the brakes hold a monopoly in these positions, the application of continuous power having interfered in no way with the original arrangements of these brakes.

The increase of train accidents, and the growth of public sentiment in favor of improved means of controlling trains, can be traced very clearly in the records of the Patent Office. Singularly enough the American public have never looked with any favor upon signals as a means of averting accidents. They call for means of seeing the track at all times, and for facilities for stopping in time to avert an accident after an obstruction is perceived.

INCREASE OF PATENTED BRAKES.

Very few patents for brakes were applied for during the first fifteen years of railroad operation. The officials in the Patent Office were not very well informed tn those days regarding brakes, for in 1847 we find them reporting, "two patents had been granted for valuable improvements in carriage brakes which it would be difficult to describe intelligibly, and which will therefore be passed over." One of the "valuable improvements," alluded to was a worthless bumper-brake that never amounted to anything and was utterly impracticable for the purpose for which it was intended. After this, the call for a good brake drew so many inventors upon the field, that before many years passed the Patent Office authorities had their experience wonderfully developed in that line. The year 1849 recorded five patents. In 1852 patents were granted to ten inventors of brakes, among them being the first steam brake, which was patented by Thomas Walber. A patent was taken out this year for equalizing the pressure on the blocks by means of springs. Few patents were granted in 1853, but two of them made their mark. The Creamer brake made its first appearance, and Stephen Morse, of Springfield, Mass., patented a cast-iron brake shoe, to be hung in such a position that it would fall from the wheel by its own gravity when not in use. The device invented by Wm. G. Creamer, was the attaching springs to the brake staff and winding them up like the main spring of a watch and holding the tension by a pawl which kept the brake off. This pawl was connected with the bell rope, and the engineer, when he needed to make a sudden stop, could apply all the brakes by jerking the rope. This brake was greatly improved in 1856, which made it the most successful emergency brake in use till the air brake appeared. By the year 1854, when twelve new brakes became candidates for patronage, the period of brake improvement may be said to have fairly opened. Every succeeding year found increasing lists of new brakes, and inventors are still laboring industriously in a line that is now pretty well crowded.

CHARACTER OF EARLY BRAKE INVENTIONS.

Among the numerous brakes invented since 1850, there have been many devices possessing neither practical merit nor inventive ingenuity. Not a few of the appliances, on the other hand, showed the stamp of decided mechanical ability in adapting means to an end extremely difficult to accomplish. About this time, a persistent struggle was made to produce an easy working and practical continuous brake, where the engineer could control the train at will. In this respect the Creamer brake was too one-sided. It was all go, or all stop. Different forms of bumper brakes were tried, and chain brakes were invented in various shapes. The first practical brake of the latter form was the Loughridge, which was invented in 1855. It was a chain brake, and worked fairly. More than one attempt was made to do the braking by means of shoes that were dropped on the rail and received pressure from the weight of the car. By those who supposed that sliding the wheels gave perfection of retarding force, the rail shoe plan was strongly urged, for it seemed to obtain the maximum holding result without damaging the wheels. To provide an automatic brake that would stop the train when the coupling parted, several complex devices of cogs, ratchets, chains and minor connections were produced. The trouble with these inventions was that the parts were too numerous for the rough usage of train service. Different bumper brakes aimed to be automatic in case of accident; but as none of the early inventions of this kind worked satisfactorily in making ordinary stops, their merits for meeting emergencies were never developed.

DIFFICULTIES ENCOUNTERED IN PRODUCING A GOOD CONTINUOUS BRAKE.

Surprise is often expressed that none of the numerous inventors, who devoted their attention to brakes, succeeded in producing a practical working continuous brake before the air and vacuum brakes achieved success so late as 1870. The probability is, that several of the inventions between 1845 and 1860 might have been developed into fair continuous brakes, but railroad companies gave inventors no encouragement. Most of railroad managers considered that the hand-brake was perfection, and they had no patience with inventors who disturbed the public mind with the impression that a safer and more effective brake could be produced. Where an appliance has to perform the complicated functions required of a continuous brake, the parts have to be finely adjusted and well proportioned for the work they must perform. To adjust a brake so that it could be operated effectively from one point, and yet be strong enough in every particular to stand the rough jostling of a train in rapid motion over an uneven track, where no two trucks stand in the same horizontal plane, was an extraordinarily difficult mechanical feat. All the details could hardly be evolved complete from the brain of the most accomplished inventor. Experience and observation in actual service were needed, so that weak points might be strengthened and mistakes rectified. Numerous valuable inventions that were crude on first conception have been perfected in this manner. The first continuous brake needed to go through this ordeal, but it was practically impossible to induce railroad men to give it the opportunity for a thorough trial. An inventor might have the elements of an excellent brake, but if a minor part failed in a trial reluctantly granted, the brake was sneered into oblivion.

If railroad authorities in this country were slow in recognizing the necessity of a good continuus brake, those of other countries were equally behind. And with American inventors and American railroad managers lies the credit of having produced the only good automatic brakes that have been applied successfully in stopping trains.

A new pleasure is in store for the small boy and a new agony is prepared for the man of nervous temperament. A woman of mechanical proclivities in Illinois has invented a toy for the production of loud explosions. We always considered the average 4th of July cracker torture enough when properly manipulated, and we would move that, if the toy for making loud explosions is going to increase the annual tumult, the users and the inventor be sent together out to the barest prairie of Illinois where they can enjoy a monopoly of the racket.

Balancing and Hoisting Moulds.

BY THOS. D. WEST.

The balancing and hoisting of moulds is an operation that often involves experimenting, and sometimes results in loss of life or limbs. Of course there are a large number of moulds that one can readily hitch to, but again there are a large number that require good mechanical judgment in hoisting.

In hitching to moulds there is one thing that is very apt to be overlooked. The general impression is that if the crane blocks hang directly over the center of a mould's weight it will hang level when hoisted up. This idea is not correct, as will be seen by the simple example illustrated in cut marked *Test*. This block, instead of being suspended by an overhead fulcrum, is let rest upon an underneath fulcrum. The block is divided by a dotted line. Each of the parts *B* and *A* weigh exactly alike. Still you have to deduct $6\frac{76}{100}$ pounds, or nearly 7 pounds from *B* and add it to *A* in order to make the block balance, as shown. This will be readily understood by those who have studied the principle of the lever, and illustrates that a mould's center of weight is not always its balancing point, and that instead of guessing for the center of weight we should guess for its center of gravity. Some may ask, Is there not a more intelligent way to hitch to a mould than by mere guess-work? There is no practical way. Of course the weight might be figured, and its balancing point be determined, but the time involved makes such a course impracticable.

As shown by the plumb-bob line, the fulcrum or lifting chain is directly over the center of gravity of the weight. This is obtained through the regulation of the slings shown hitched to the lifting beam.

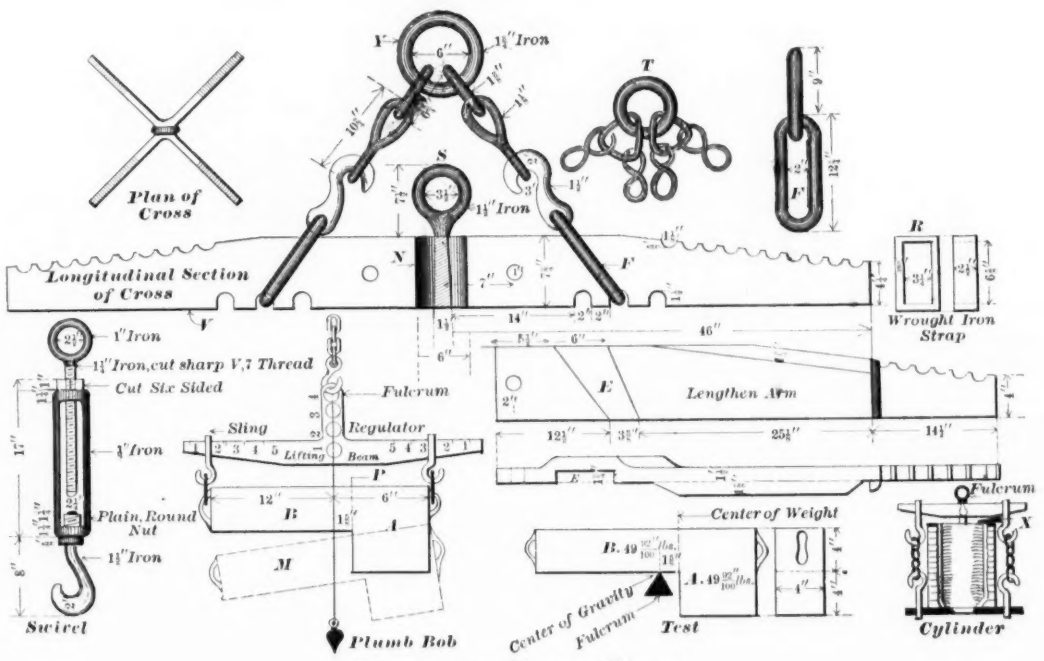
The regulation of slings to make a mould balance, although apparently so simple, is an operation that sometimes puzzles a moulder. It sometimes troubles the novice to tell which way the slings should be moved upon the lifting beam, when they find a mould hanging similar to the weight that is shown in dotted lines below *B*, *A*. The cause of such unlevel balancing would be that the fulcrum or lifting block was hung over the point *P*, the right-hand sling set in the beam's notch No. 4, and the left-hand sling set in No. 1. To make the weight hang level they must be placed as shown, remembering that moving a sling towards the center of a beam lifts up the mould's side or end, and that moving a sling towards the end of the beam lowers it. I have seen first-class moulders obliged to think for a while before they could tell which way the slings should be moved.

About the most dangerous class of moulds with which we have to deal are those similar to the one marked *Cylinder*. In lifting such moulds extra care must be taken or the mould will turn over. In hoisting any mould, as long as we can have the largest portion of its weight below the point by which it is lifted there is generally little danger of its capsizing. Some, in hoisting such a mould, will drive wedges beneath the cross or beam, as seen at *X*. This is, no doubt, a good plan to adopt in hoisting top-heavy moulds. The further from the beam the point from which the mould hangs is, the safer it is. In the beam shown lifting *B* and *A*, the chain hook is hitched in an upright rigid beam at right angles to the main beam. In this upright beam are four holes. The fourth or upper one is the fulcrum point. It illustrates how we can regulate this point. We will suppose that this beam has no weight upon it, thereby allowing us to rock it back and forward. After noticing how much force it will take to make its end strike the chain, we will then cut off the top down to hole No. 3. The hook being hitched in this hole, we again try it, and so on down to No. 1. Now I think it is very evident that with the top three holes cut off, and No. 1 used for the fulcrum, it will not require much force to turn it entirely over, did the chain not prevent it.

This explanation will, I think, prepare for an understanding of the principle and advantages of the cross shown above this one. The ideas embodied in this cross, and its lifting slings and hooks, are such as can be applied to all classes of beams. The rigging, as shown, was devised by R. B. Swift. It is the first cross of the kind I ever saw, and as I am seeing it used almost every day, I know it to be a valuable appliance. The ordinary plan of hoisting with crosses is to hitch to the eye *S*. By this plan the fulcrum is but little above the center *N* of the beam. Now, as we have seen that the higher we raise the fulcrum, the harder it is to tip up a beam, we must acknowledge that by hitching at *Y* and having the hook slings spread apart as shown, it would be a hard matter to tip over a mould, even in hoisting top-heavy moulds, similar to the cylinder shown. No wedging (as at *X*) is required.

If the mould does not lift exactly level there need be no fear of its tipping over. Another feature of this beam is that its straight face *V* is underneath. This construction is good, as it gives a more reliable surface to wedge against when using the cross for binding a mould together to be cast. Still another good feature is the lengthening arms, of which there are four. At any time should a longer beam or cross be wanted, they can be readily attached.

R is a wrought iron strap used to bind the outer end, while a bolt is inserted in the holes seen near the center *N*. *T* shows the lifting eye *Y*. The sling seen at *F* is another view of *F*, as seen hitched to the cross. The swivel shown is a well devised one, and is very handy for adjusting or binding heavy loam moulds when being hoisted or got ready to be cast.



BALANCING AND HOISTING MOULDS.

Memorial to Richard Trevithick.

Among the mechanical engineers who labored in the early part of this century to develop the steam-engine and to adapt metals to popular uses in arts and manufactures, Richard Trevithick deserves a prominent place in the world's esteem. He was endowed with wonderfully fertile inventive faculties, and they were devoted during his whole lifetime in working out the practical problems of applied mechanics which substituted machinery for manual labor. He was the first to construct a practical working locomotive-engine, and Headley and Stephenson, the improvers of this engine, were more indebted to Trevithick than the world generally is aware of. Unfortunately for himself, Trevithick's inventions were always away ahead of his generation. He left a mine of inventive wealth in the patent office which hundreds of constructors have made fortunes on. His specifications gave suggestions that other men utilized to make themselves famous.

Trevithick, like many other talented inventors, had no business abilities, and for want of these the fruit of all his discoveries went to others. Had he met a business partner such as Watt found in Boulton, the name of Trevithick might stand second to none among the engineers who conferred upon the world their labor of genius.

A movement has recently been started in London to raise a fund for the purpose of making some memorial that will signify the appreciation of Trevithick's greatness. A statue is spoken of, also an endowed scholarship, to aid in the technical education of engineers. If any Cornishmen or other Englishmen in this country wish to aid in doing honor to their countryman, their subscriptions will be received by Mr. Henry Chapman, 113 Victoria street, Westminster, London, S. W.

A pyrometer, based on a somewhat novel principle, has been invented in Britain for ascertaining the temperature of furnaces and other intensely heated substances. The new pyrometer consists of a piece of metal of exact weight being subjected to the heat for a certain time and then plunged into a measured quantity of water. By calculations based on the rise of temperature of the water the heat of the furnace can be ascertained.

The ambition to produce a spring motor which could be applied to the driving of sewing machines has brought disappointment to many inventors in this country. Those who have labored over the problem so apparently simple, and yet so charged with defeat, will be gratified to learn that English inventors have started in pursuit of this ignis-fatuus. An inventor claims to have made the spring motor a success. He winds a band-spring into a "parabolic spiral," and its name or the arrangement compensates the action of the spring in running down so that the same speed is maintained till all the power expended in winding has been exhausted in driving the sewing machine. We never heard of the "parabolic spiral" before, but we have heard of all the other particulars, and we are hardly satisfied that the problem of a convenient sewing machine motor is solved.

The latest issue at hand of the *Australasian Trade Review*, of Melbourne, gives rather an unsatisfactory account of the state of general trade in Australia. It says:

"Prices generally have been further forced down, and it is difficult to say in what directions the large houses are making profits. It is becoming a serious question whether the whole scale of profits realized in this colony is not too low. Importers, distributing houses and retail dealers in the towns work for smaller profits than the same classes do in England, the only compensation consisting in the higher ratio of consumption ruling here. For the moment prices of several heavy staples are below absolute cost, and while this state of things continues a risk affecting commercial credit must exist. To trade not merely without profit, but at a diminuation of capital resources, cannot be sustained for an indefinite period."

In spite of this depressing situation, however, one industry seems to flourish. A little further along we read:

"From the banking point of view it is highly satisfactory to read in the last issue of the *Banking Record* that 'bankers say that the demand they experience for money is illimitable and insatiable, the majority of securities offered being such as they would not turn their backs upon if they had available means free.'"

Workshop Economy.

BY S. W. GOODYEAR.

That certain proprietors of workshops and manufacturing establishments should through a desire to conduct business on a basis of economy, become so blinded to the benefits to be derived from a liberal outlay for small tools and appliances to be distributed judiciously among the help employed by them, is no doubt due many times to an innate disposition to economize in all things, or to the effect of early teachings of those upon whom they have come to look as model business men. They appear to consider that all money expended for such conveniences is so much wasted—always putting the virtue of *saving* before the faculty for *making* money.

That misers, whose gettings were small, have accumulated fortunes through saving, is true, but it has been done through hardship and deprivation on their own part, and with little benefit pecuniarily or in the way of added enjoyments to those connected with, or surrounding them. Not that extravagance should be the rule, but that a close reasoning, calculating expenditure for tools and appliances by the use of which work may be well done in the most economical manner, is undoubtedly the true doctrine, and in many branches of manufacturing and mechanical operations has become a necessity. Through the policy of those proprietors or managers who always object to the outlay of a dollar for tools as long as they can "get along without," there is among the help employed by them a lack of satisfaction, enjoyment, and it might be said luxury, which would come from the use of needed conveniences. It is akin to that of the miser's family, who seeing plenty all about them, and knowing the ability to provide of him to whom they have a right to look for the comforts and conveniences of life, are still obliged to rub along hungry, growing sour and morose, with sensibilities blunted till they become alike careless and indifferent to their own wrongs and to the rights of others.

No less hungry is the true mechanic for the satisfaction and advancement to be derived from the use of suitable tools and appliances than is the miser's family for the bread which is withheld. In his case the suffering—for it is suffering—comes from miserliness as much as in the case of the family whose just dues are being hoarded for the sake of gain.

While there is little hope that the natural penuriousness of these false economists may be overcome by any amount of reasoning, it seems strange that they should not oftener be led by their own love of gain to see that their neighbors by the judicious expenditure of money for improvements, are really *saving* through the reduced cost of operations performed.

It is not uncommon to find in machine shops so great lack of all small tools and conveniences as to occasion among the hands employed almost a continual waiting of somebody for something which some one else is using, or more provoking yet, looking for, and hindering half the help in the shop by vain inquiries for some tool which has

been mislaid or broken, of which there was but one. In this way sufficient time is often spent in vain search to pay for the tool twice over. In a lack of suitable wrenches, and enough of them, is to be found a source of much loss and inconvenience, with actual damage to machinery. To be without an abundance of the best monkey wrenches, kept in first-class order and accessible on the instant to all who are likely to need them is inexcusable. The inconvenience and loss occasioned by the absence of "the monkey wrench" just when most needed, would pay for a whole dozen to be scattered where one at least could always be found. To use a monkey wrench on nuts and screw-heads where a great number of the same size are to be frequently turned on the same machine instead of using open or box wrenches is less excusable. To use open or box wrenches on nuts or heads which they do not fit, by placing in one side the first handy thing to force a fit, is least excusable of all. How often a monkey wrench is used for clumsily and slowly removing or turning in screws where seven-eighths of the time could be saved by the use of a cross-handled socket wrench. With hours of time spent daily in screwing up and unscrewing, in screwing in and taking out, the many nuts and bolts and screws with which a machinist or machine operator has to deal, he should be well provided with suitable wrenches. He who *saves* a dollar by not paying it out in this direction when called for, is often the loser in consequence, of ten dollars in time, besides paving the way to certain repairs by injury done to heads and nuts by badly fitting wrenches.

A terribly expensive economy is that of getting along with a dearth of lathe dogs. Better a full set of dogs for every lathe in the shop than to have lathes stand idle for need of them. Ten dollars worth of dogs may be borrowed and loaned from one lathe to another, or one room or shop to another, until hundreds of dollars' worth of valuable time is consumed in carrying them back and forth.

To get along without such straps and bolts as are sure to be needed for securing work on lathe or planer until necessity compels that they shall be had, and everything must wait until they can be made, is the common practice in some shops, while of such bolts as can be found many are without nuts, or threads are stripped, or nuts can't be turned. Who does not know that in having a large assortment of straps and bolts of various sizes and lengths, with nuts well fitted and always to be found on the bolts to which they belong, with an abundance of washers and untapped nuts, removing the temptation to take all the nuts from the larger bolts to be used as washers on the smaller ones, or for blocking, there is a saving of time which more than equals the saving of money in rubbing along without?

To see, in some shops, the makeshifts year after year, and almost daily, to avoid putting out the money which a convenient lot of handscrews would cost, seems strange, and especially to see a pattern maker clamping pieces together by the use of notched bits of board and taper keys, because it would be wasteful to buy that which he can make a substitute for. That the substituted home-made appliance is not as good, and does the work less perfectly, taking much longer to adjust, and that the aggregate of time spent in a year in making improvised clamps would more than pay for all the handscrews he would need in a lifetime, makes no difference to our close-fisted economist. He sneers at the wastefulness of those who must have all the new-fangled appliances, and says he "gets along well enough." Ask him to invest in universal drill chucks and an assortment of straight shank-twist drills, and he says no. He don't believe in twist drills, flat drills are good enough for him; "can make them when wanted to suit ourselves," he says. Let's watch him. He uses taper shank drills. As a matter of economy he makes two sizes of chuck cover the entire range of sizes from 1″ diameter down to the smallest used. As it would be contrary to his ideas of economy to get out a stock of drill blanks in advance, and have the shanks turned to fit the chucks properly, the most of those which have been turned at all have had that operation performed in a hurry, while the job on which they were to be used stood waiting, and to relieve his conscience of the sin of wastefulness which he believes would be committed, should he have a large stock of drill blanks got out, and shanks turned in advance of an actual requirement for them, he has them turned up one at a time. Think of it! Consider the proportionate difference in cost of turning to fit a hundred taper shanks at once, if so many will be wanted in four months, or turning an average of one each day, one at a time, setting the lathe to a taper for each. Look at the cutting and trying to get the lathe set right for the taper, and set back right to turn straight again. No more time would be taken in this way for one hundred pieces than for one. As between the expense of turning and fitting a single shank by the usual cut and try method, and that of performing the same operation on each of one hundred in one lot, in a systematic manner, it is safe to say that by the one-at-a-time process the cost will be from 200 to 300 per cent. more than

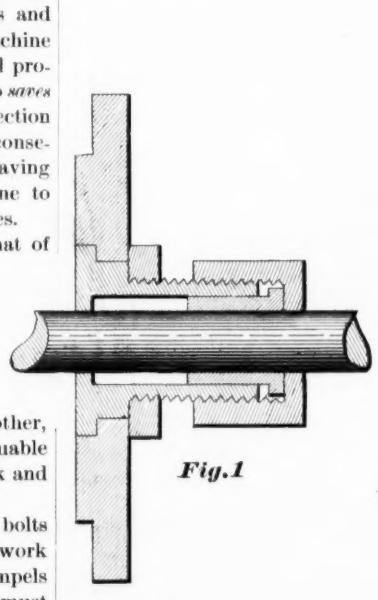


Fig. 1

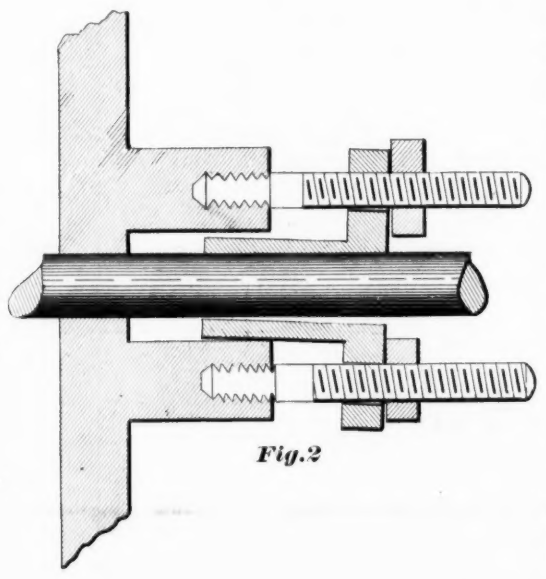


Fig. 2

better work would cost if done by the hundred pieces in one lot.

Now, if I don't explain of course some will say that I "have put my foot in it." Let's investigate. The one-piece-at-a-time man gets his blank piece of steel centered and ready to drill, and finds mayhap no chance without waiting for some one else to get out of his way, or finds no drill to use and has to make one or wait for the tool-dresser to do it. If he turns the piece without drilling the centers he will injure the lathe centers, to repair which will cost more than it would to wait, or to make the center drill; but this sort of economists are just the men to do that sort of thing. With the one hundred pieces to center, and centers to drill and countersink to the angle of the lathe centers as they should be, who does not know that the entire hundred can be done at less expense than will attend the same operation on twenty-five pieces when done one at a time from day to day?

Now we come to the turning, and after watching the ordinary one-at-a-time man—not one of those rare and wonderful workmen who know intuitively just how deep to set a tool, and go boldly right to the mark within a millionth part of an inch the first time trying, for I am not writing for them. They are as much beyond my comprehension as an electric light of four thousand candle power is beyond a glow-worm. He sets his lathe pretty near right, and carefully sets his tool in for the first cut, as though he was afraid he would go too deep, and runs across. He tries the taper, and concludes it is not quite right, alters the lathe a little, and takes another cut, and so on till he gets through, having run over the piece twice as many times as necessary, and finally in many cases if a fit is had, making it by filing. Now let us look at the way an ordinary man may be made to do the same work better on one hundred pieces. First, let all the pieces be squared up to the same length and centers countersunk to the same depth. Next let the lathe be set for the taper to an exactness which will call for no filing to a fit. The time can be taken now to set the lathe accurately, for all time spent in that way is to be divided among one hundred pieces, instead of being spent one hundred times on as many pieces.

Now with the lathe set all right—two lathes if they stand at convenient distance from each other and can be spared—with tools set to take all the cut which power, spring of piece under treatment, and proper working of tools show to be advisable, with two dogs if one lathe is used, and four if two lathes are used, always have a piece dogged and center oiled, ready to put in the moment the piece preceding it is taken out, leaving the tool in one position as long as it cuts well and to the size required, till a first cut has been taken from every piece in the lot, and so on for finishing cut and all. Dogging the work can be done while the lathe is running, and changing one piece for another, with the advantage of having all pieces treated alike down to the finishing cut, thereby having the same amount to turn off in the finish, insuring uniform size. This does away with all guess-work, and if any machinist after learning how much work has been done by the one-at-a-time method for one hundred dollars can't take the same amount of work by contract for twenty-five dollars, and make more than day's wages, he had better give up the business.

But this is not the worst phase of this drill-shank business. There will be times when turning can't be waited for, and the shank will be driven into the chuck just as it left the anvil. Then good by to any fit for those which may have fitted before. Nor can this saving class do as good drilling, nor as much of it, as those who use twist drills, which may be had within one thousandth of an inch of any exact size required, and hold their size for many successive grindings.

But to attempt a detailed review of the economics of these *savers* would need too much space. To make the man who sweeps the shop floors use an old stub of a broom, whereby one dollar's worth of sweeping costs three dollars' worth of time, to save paying out a quarter of a dollar for a new broom; to save all the old bits of string and knot them together for wrapping twine, and in consequence spend ten cents worth extra time in tying parcels, all to save the tenth of a cent's worth of twine; to continue to do by hand some job of work requiring the services of three or four men, which could be done by one man with suitable machinery; to instinctively brace themselves on all occasions and under all circumstances against any and all attempts to draw them into any investment in new things, are among the saving virtues of over careful economizers.

The old way good enough, is it? Let's wind up with a recital of an actual occurrence. A manufacturer operating a number of machines—more than one dozen—found himself short one machine of what was needed to turn out the amount of goods required. Going to the machine builders from whom he had purchased the machines a few years before, to order the machine wanted, he was told that the pattern had been altered, the machine much improved, and the price raised about thirty per cent. "All right," he says, "my machines are in perfect order, and do their work entirely satisfactorily, still I am always ready to do better." The new machine was built and set at work, resulting in a second visit to the machine builder, and an order for a dozen of the improved machines, with this statement: "I can't afford to run the old machines, and shall throw them all out as soon as the new ones can be started. I thought my machines were all right and was satisfied. I knew that some of my competitors seemed to have an advantage. I see now where the advantage lies. The new machine will do thirty per cent. more work with less care and expense for running."

LETTERS FROM PRACTICAL MEN.

Valve Rods without Outside Guides—Troublesome Stuffing-Boxes—Local Boiler Setting—Safety Valves.

Editor American Machinist:

One bad feature frequently seen in cheap engines, and one that causes trouble by introducing irregularities into the valve motion and wears out stuffing-boxes and glands, and speedily destroys packing, is the valve-stem without a guide outside. Such an engine will waste the cost of a guide every year in packing, and will waste steam and wear out glands enough in a few years to pay for an engine.

Engineers all know how troublesome the stuffing-boxes of an engine will become from neglect or long usage, or both, through the constant tendency of the piston and rod to wear out the bottom of the cylinder and stuffing-box. It is coming to be the custom to cast the cylinder head and stuffing-box in one piece, and worse than this, in some instances to cast them in one piece with the frame. When it becomes necessary to repair some of these parts the engine must be removed; a job not easily handled in the average job shop.

Fig. 1 represents the plan adopted by Skinner & Wood, Erie, Pa., to overcome this difficulty. The stuffing-box can be removed at any time, leaving the engine undisturbed.

Fig. 2 is intended to represent the effect of the judgment of inexperience, and two bolts, in setting up a stuffing-box gland.

Mistakes are likely to occur in setting boilers by local talent. The Durham Packing Company, of New Gloucester, Me., have two return flue boilers set so that, instead of returning through the flues, the gases travel the length of the boiler and then escape up the chimney. To make matters a little worse, they feed with cold water.

The common lever safety valve is a dangerous affair. How many stop to consider how much they load the valve when they hang five pounds on the end of the lever? Use a "pop" valve, and it cannot be loaded with old iron. Herbert Penny.

Two-Part Straps for Connecting Rods.

Editor American Machinist:

I have often experienced the difficult job of repairing connecting-rods that have been worn and require new brasses. The straps are frequently worn larger at the back than the stub or block, and often narrower edgewise, making it impossible to fit new brasses that will be tight when in place. I want to suggest that the straps be made in halves—parted in the middle at the back, and held together by a turned bolt in the same manner as they are held on the stub or rod. By doing this the brasses can be fitted tight, as they do not have to be slid in at the open end of the strap, but can be planed as large as the stub, and will be held as tight as the strap is held on the rod. Being fitted brass to brass, locomotive fashion, they can never move; consequently they can never wear. The straps made in this way will not cost any more than the old style, perhaps, and are much easier taken apart, just as strong, and look just as well.

I make this suggestion in the hope of entirely preventing wear in the straps, as well as to facilitate repairs. I should like to hear the opinion of railroad master mechanics and other experts on this subject. Forty-Niner.

Dealing with a Cranky Superintendent.

Editor American Machinist:

In issue of September 29th, F. J. Masten tells us how to get along in the shop, at the same time criticising Q. K. quite severely.

It cannot be that Mr. M. read Q. K.'s statement, in issue of August 11, very thoroughly, for not only does he make a mistake in the initials Q. K., calling them D. K., but shows a lack of ability of judging mankind.

When Mr. Brown came and told Q. K. the job was wrong, that Johnson & Company would not pay, it was evident that either he or his bookkeeper lied. As the bookkeeper had no object in lying, and Brown gave three false reasons for not doing the job, the third one being given in an indignant tone before the lathesman, he certainly did not act the part of a man, even if he did not lie.

It looks as though he wanted a man to be foreman only when he was away or when he had some dirty job to be done.

Such things do not tend to help the foreman to maintain discipline in the shop. In one place Mr. M. says employes are but human, and they will bear a little management as well as other people, but it must be done good-naturedly or not at all. Here he is only half right, for the temperament of mankind is decidedly varied. Some can be swayed by kindness, some by witticisms, while some must be conquered before they can be managed. M. was working for the second class. Let him try the third, and his witty answers and good-natured responses would be of no more value than a puff of smoke.

I once worked for the latter kind, and will give my experience. I was foreman in a repair shop for a large mill, where a superintendent was employed on about the same plan that Q. K. was (a sort of a go-between).

The superintendent liked my management, but when the owner came round (which he did twice a day), I used to catch it pretty hard.

Nothing ever suited him. If anything went wrong in the mill he would vent his wrath upon me as soon as we met. It being in the fall of 1877, when times were hard, I had to grin and bear it, never replying by word or look otherwise than kindly. Things went from bad to worse for three months, not a day passing that I was not cursed or growled at. Some of my men took advantage and harassed me at every opportunity.

Finally I went to a friend for advice. After stating the case to him, he told me to go to the superintendent, give my notice to quit, and if he asked my reasons to tell him.

I gave my notice. At once he demanded the reason, when I told him the trouble from beginning to end. He admitted that I had been abused, but he could not remedy it. He wanted to know on what conditions I would remain. I replied none; without he would agree on his honor to tell the owners just what I told him, to which he assented. These were the conditions: First, my pay was to be increased; second, if I did not give satisfaction I should be discharged, but not abused, with the positive assurance that if he ever swore at me again I should thrash him soundly, if it was within my power.

The consequence was I worked three years thereafter without a word of trouble, and when I came to leave them, he shook hands and bade me good-by, wishing me well, saying that my new situation was better than he could give me, and that I was deserving of it.

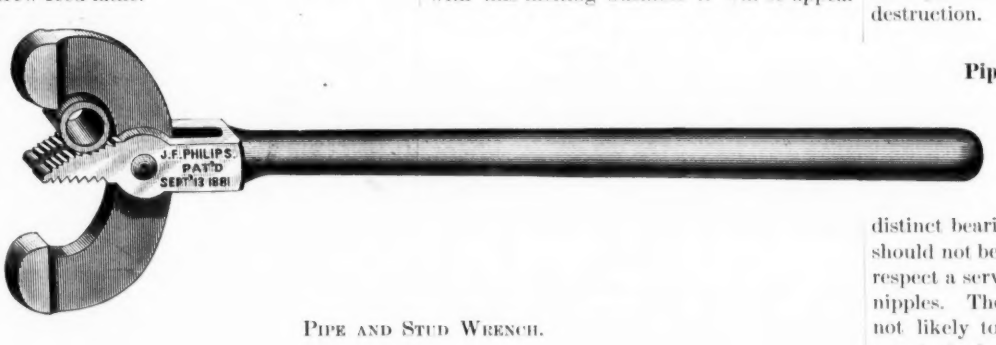
That firm has employed within the last four years no less than fifteen different superintendents and overseers.

I appreciate the Golden Rule, but when a bull is bound to hook you, take him by the horns. Sacking.

Suggestions About a Lathe Feed—Some Shop Wrinkles.

Editor American Machinist:

Had Chordal gone a little further while examining lathes, and had a look inside of the carriage-apron I think he could have seen some more of the "unholy mechanism" recently witnessed in the little wooden house on that steam engine. Perhaps it wouldn't be a bad idea to have a door formed of the apron, and carrying the feed mechanism so it could be unbuttoned and swung down for oiling and general repairs once in a while. Old-time lathes are found with a single screw for feeding on all work and cutting threads also. The objection to this is the wearing of the screw in time, so that accurate screw work is made impossible. Had the builder gone a step further and placed a screw on the opposite side of the lathe, I hardly think the rod and friction with the complicated apron would hold its present position. Such a lathe, with a screw on each side, and the swinging arm carrying the stud and gear arranged to gear in either screw, one of which should be used for all feeding, roughing heavy screws, and cutting such threads as it might; the other for finishing or accurate screw cutting, would be a benefit to owner, builder and operator. The screw for feeding has several points of excellence, being handy, easily kept in order, and I think far cheaper than a rod with the frictions, &c. A cut starts in less time, is stopped at once, and no frictions are getting oily or dry, consequently there is either no feed, or all feed. The feed screw could be operated with a belt, also by having a pulley to substitute for the gear for feeding and the cross feed operated as usual on a screw-feed lathe.



Pipe and Stud Wrench.

I used to have a wrinkle for polishing, that worked first-rate and saved hand polishing, by rolling a piece of emery cloth on a mandrel and running it in a speed lathe, the cloth being held in place by rubber bands or rings and rolled so as not to catch the work while revolving. Another wrinkle was to fill up an old pipe coupling with lead or babbitt for driving mandrels, &c. I don't claim either of these as new. P. C. Forrester.

Melting Iron—High and Low Tuyeres—Hard and Soft Iron.

Editor American Machinist:

So much has been written from time to time on the subject of melting iron in cupolas, and such diversity of views on the subject set forth, that to the general reader it must be a matter of wonder why no mode can be adopted whereby the amount of a given kind and quality of fuel necessary to melt a specified amount of iron may be determined.

I believe such a rule is quite within the compass of man's ability as will settle that hitherto vexed question; settle it, too, with the unerring accuracy of the multiplication table. This may and must be done by experiments, often repeated, and by men situated so as to give fair and intelligent statements of tests.

That a very large proportion of foundrymen having control of the use or misuse of fuel do not possess any adequate knowledge of its power, is humiliating. All waste of labor or its products is at once a national as well as an individual loss.

That we of the foundry business are far, very far, from anything like a clear knowledge on this matter, will be manifest by the re-perusal of two articles that appeared in the American Machinist of September 15 and October 6. In the article in first-mentioned date, we are informed that four foundries in Cleveland, O., do thus and so, and "these four specialties cover about all ordinary foundry practice, so that nearly all can apply one or the other to their own practice." This language points to having reached the limit. Not so thinks P. L. Simpson, of Minneapolis, however, for straightway he assures us that he "melts iron in all respects satisfactorily" with an amount of fuel about one-fifth less than the best melting in the four foundries in Cleveland. And Mr. Simpson does not claim to have reached the highest possible results.

Can anyone give a rational explanation of why tuyeres in cupolas should be set thirty inches, or even one-third that distance, from sand-bed? Answers will be numerous enough, no doubt, all having one refrain, namely, that where large castings are to be made you must have a reservoir. Must you, indeed? And what, pray, is your ladle for?

You must keep it hot! Let us see. Your iron melts at the surface of fuel, and falls through the body of fuel in its passage towards the tapping-hole. It is clear that in that journey it is passing through strata of a lower temperature than at the melting point, both as regards the fuel and the cold air of blast at tuyeres. It would appear the act of wisdom, if hot metal is desired, to remove the metal from the action of the blast as quickly as possible.

"No, no," says Custom; "keep the tuyeres high for heavy casts."

It has often happened in man's experience that that which has long been accepted as "just right" has to a subsequent generation been proved so ridiculous that the only wonder was that men could have been found to entertain so gross an absurdity.

I am very clear that by the time we get done with this melting business it will so appear in the case of high tuyeres being a necessity.

Surely it should require no argument to show that the metal tapped from a furnace into a clean hot ladle, the metal covered with fine charcoal or even dry dust in thick layer from the floor, will hold its heat better than in the cupola with a streaut of air on top of it. I have known metal stand full three hours in a tank, and then tapped, good fair running metal. Nor is the large and unnecessary expenditure of fuel by any means all, or even the worst, of this high tuyere business. I refer to this high tuyere system as having a tending to make hard castings. Of course, this will not be felt where rolling mill castings and the like are made; but in general castings, and particularly pulley making, the matter becomes serious.

A few years ago the writer was requested by a large metal-dealing firm of New York City (Thos. J. Pope & Bro.) to proceed to the city of Bangor, Maine, and see what could be done with a firm of that city (the Bangor Foundry and Machine Company). They had 130 tons of pig iron sent them from the New York firm referred to, as soft iron. The Bangor Company had tried to their utmost, still their castings (machinery and stove-plate) came so hard as to be ruinous to their business. The Bangor people had by this time entered suit to recover one thousand dollars damage; also ordered the New York firm to take away the remainder, about 75 tons. On my arrival the company civilly permitted me to prove to them the correctness of my assurance, viz., that they had a most excellent stock of metal. I attended to running the furnace. The following morning the castings were declared by the superintendent—and, indeed, by all hands—to be soft enough for anything. Could I, or would I, do it again? For six successive days the castings came so that the superintendent said he could cut them with his knife. Now, in this case the metal I melted was precisely such as they had been unable to put to any good use. The change was entirely due to the following alteration in management of furnace: The sand-bed was raised as far as the breast would allow for tapping-hole; a plump one-fourth less fuel was used on bed and throughout; the wind damper was opened full. We had little occasion for the use of the stopping stick, and the results were as stated. I may mention, too, that the fast melting rather bewildered the workmen. The further results were the withdrawal of litigation, a letter to the iron dealers of New York acknowledging that they, the Bangor Company, were all wrong in the matter, and good feeling all round. This melting subject is by no means exhausted. I will refer to it again.

Let no one suppose that the above treatment will make hard iron into soft: it will not. The point is, using more fuel than is necessary, and subjecting the metal for a long time to the action of free carbon from the fuel, will affect some kinds of metal in a great degree. James Tullis.

Among other valuable relics of early mechanical art destroyed by the burning of the Pittsburgh exhibition building was the old locomotive "Arabian." This was the first grasshopper engine built for the Baltimore and Ohio Railroad, and was one of the first locomotives that did regular service on the road. It was exhibited by the owners at the Chicago Exposition of Railway Appliances, and attracted much attention from visitors. The Baltimore and Ohio Railroad Company took great care of this relic of the road's early history, and much regret is felt about its destruction.

Pipe and Stud Wrench.

The engraving represents a pipe wrench by E. D. Eames, Watertown, N. Y. It will be seen that the wrench has three distinct bearings on the pipe, and therefore should not be liable to crush it, it being in this respect a serviceable tool for removing short nipples. The construction is such that it is not likely to slip, and that a new "bite" may be had with very little movement of the handle. While especially adapted for gas and steam fitters' use, it is a most convenient tool for screwing out studs, and for work of a similar nature.

Patrick Kennelly, Bridgeport, Conn., has patented a protractor made with a revolving center. The center consists of a half disk, the flat edge of which corresponds with the center of the protractor. If the center can be kept true it will be found a useful improvement.

Record of Locomotives on the New York Central and Hudson River Railroad.

Mr. Wm. Buchanan, superintendent of motive power of the New York Central and Hudson River Railroad, has in his office at Forty-second street the most complete system of showing the condition and whereabouts of all the locomotives on the road which we have seen. Each division of the road is represented by a panel, and the engines are indicated by pegs which are numbered to correspond with the individual locomotives. Each division has a color belonging to itself, and the pegs belonging to that division are colored accordingly. So in glancing over the various division panels, an engine that is off its own division is readily identified. Figures on the pegs indicate the size of the engine's cylinders and wheels, and the kind of service it belongs to. Sub-divisions of the panels represent the condition of each engine, and the engines are arranged according to data received weekly from the division master mechanic. The sub-divisions tell the engines that are employed on passenger service, those on freight service, the engines that are switching, also the number in reserve, those under light and heavy repairs, and the engines out of service. By this means Mr. Buchanan is able to tell at once the condition of every engine under his charge, even down to the thickness of the tires. A daily record panel shows where every engine is running or stationed, that board being arranged according to information received by telegraph every morning.

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NEW YORK, OCTOBER 27, 1883.

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Transacting Business with the Patent Office.

A correspondent, who, like a good many others, is uncertain as to the proper course to pursue in the transaction of business with the Patent Office, writes as follows:

I desire to obtain a caveat on what I consider an improved duplicating process. Am I obliged to pay an agent to procure the same for me, or can I obtain the necessary papers by addressing the Commissioner of Patents and write the description myself? I am told that the business must absolutely be done through an agent.

There is nothing in either law or reason why if our correspondent is competent to prepare the requisite drawings and specifications, he should not be able to transact the necessary business directly with the Patent Office. Those, however, of much experience in this direction are apt to find occasionally, at least, a determination on the part of some official there that the business shall not be done in that way. If the applicant is stubborn enough and has an inexhaustible supply of patience, he will in the end probably carry his point, but usually after vexatious delays, that he is not inclined to subject himself to in future transactions of a similar nature. It is easy enough to say this is all wrong, but the pertinent question is what is our correspondent, or any one similarly situated, who may find himself unable to make a favorable impression in the proper quarter to do about it? We believe the instances are not rare in which an applicant for Patent Office favors finds his application subjected to all sorts of irrelevant quibbles. On the other hand, our correspondent may submit the matter necessary in his case, and have the satisfaction of getting his business through without any trouble whatever. Instances of this kind have been known, and are sometimes ascribed to good luck.

As a matter of course an applicant cannot expect the Patent Office officials to materially revise his specifications and claims, particularly as in doing so they may make him claim something he had never contemplated, perhaps anticipating the just claims of another, but his properly prepared specifications and claims should be considered in a way that is not always the present practice.

We do not in this wish to be understood as under-estimating the value of the services of a competent and honest patent attorney, or as advising that their assistance be dispensed with. On the contrary, we believe that their services in an important matter of this kind are generally worth much more to the inventor than he charges for them. But we do believe the inventor should have some option in the matter, and not be, as we think he sometimes is, subjected to the whims of those whose salaries he helps to pay, and who may have a desire to see the business come through professional channels.

What Keeps Up Wages?

The aid of the pulpit as well as the aid of the press is sought to weaken and, if possible, to destroy our protective tariff. In a recent sermon reported in the daily newspapers Rev. Dr. Rylance said that he clearly saw that protection "is nearly dead, and cannot survive long, as our industries are fully developed," though he admitted that he saw the sense of protection. He further said:

"Protection has kept up wages. When protection dies, the working class of America must live as does the same class in Europe. My advice to the laborer is, therefore, to make hay while the sun shines, and to save money so as to be able to better stand the state of affairs I think inevitable."

As protection is nothing more than adequate tariff laws, and as "the working class" constitute at least five-sixths of the voters who made and unmake legislators, the reverend doctor must assume that workmen are deliberately going to destroy the support that keeps up wages, and voluntarily reduce themselves to the same condition as the workmen of Europe. We have a much better opinion of the American workmen than that. They are intelligent enough to dissect the causes of apparently disinterested efforts to break down the tariff so as not to be mislead by them. Those who would gain by the cutting down of the tariff are foreign manufacturers and importers of foreign goods.

In spite of the most ardent efforts of free traders, our protective tariff is likely to remain.

The train brake is one of the most important mechanical appliances in operating a railroad. Several people have been killed on railroads within the last few months through lack of proper brakes and buffers. The article in this week's issue, by Angus Sinclair, on the "Growth of the Train Brake," will be read with interest by mechanics generally, whether directly engaged in railroad work or not, as it presents the subject in such a light as to be intelligible to all. Mr. Sinclair will present further particulars on this subject in a future issue.

The Apprenticeship Question.

We have received a letter from a young man who says he is a Yankee, eighteen years old, has a fair education, having been two years in the high school; can draw some, can handle tools quite readily, and can furnish good recommendations if desired. He says:

"I write to ask your help and advice in securing a situation where I could learn the machinist trade. I want a situation where I could learn as many different parts as possible, thoroughly. I thought that perhaps you were personally acquainted with machinists who take apprentices. If so, would it be too much trouble to secure me a situation? I should like to get wages large enough the first year to pay my board. If there is no chance at present do you think there will be any in two or three months? If so, I would like to know."

The above is a sample of many other letters that we receive asking for the same information. We desire to aid all such young men to secure situations as apprentices and are willing to take extra pains in their behalf. We should like to hear from shop owners who will take bright, active apprentices anxious to serve three years or more to learn the trade, and allow them enough to pay their board the first year. Those shop owners who desire that their names shall not be published as ready to receive apprentices may be assured that we shall regard their expressed wishes, in this respect. Our object is to aid both apprentices and shop-owners—the former to obtain situations and the latter to obtain skilled mechanics, or those ready to become skilled. Unless more apprentices obtain situations the supply of skilled mechanics in this country is in danger of running out. It is conceded that a few good apprentices are profitable in almost any shop. In every case let an equitable written contract be made binding both the apprentice and the employer. Who are willing to take apprentices?

A patriotic "Langtoon" Scotchman, in Philadelphia, writes us complaining about a practice that is common among American newspapers, of attributing to England important mechanical achievements which have been done in Scotland. He takes arms against a paragraph which speaks of Kirkcaldy, in England, and credits the Southern British nation with the honor of enterprise that belongs to Fife, which every one well read in Scottish lore knows to be a kingdom in its own behalf. As we believe in giving honor to whom honor is due, we warmly sympathize with Langtoon's efforts to give Scotland public justice. He may rest assured that we will not fall into the error of telling our readers that Clyde-built steamers are of English make, but we will not guarantee that other publications will distinguish exactly between the Clyde and the Tyne. Accurate geographical knowledge is not widespread.

Those who think that the Keely Motor is played out in public estimation might be interested in reading the stock quotations in New York daily papers. For many weeks Keely Motor Stock has been quoted considerably higher than the stock of three or four well known railroads. Whenever Keely is about to do something in a given time, the stock booms upwards.

Literary Notes.

MECHANICS OF ENGINEERING AND OF MACHINERY. By Dr. Julius Weisbach. Volume III., Part I, Section I. The Mechanics of the Machinery of Transmission, second edition, thoroughly revised and greatly enlarged, by Gustav Herrman, Professor at the Royal Polytechnic School, Aachen, Germany. Designed as a text-book for Technical Schools and Colleges, and for the use of draughtsmen, etc. Translated by J. F. Klein, D.E., Professor Mechanical Engineering, Lehigh University, Bethlehem, Pa. Authorized translation. New York: John Wiley & Sons, 15 Astor Place.

The standard character of the works of this author is universally recognized by all students of engineering, and Prof. Klein's name is a sufficient guarantee for the correctness of the translation. The present volume is a particularly valuable one, dealing as it does with some of the most interesting subjects pertaining to the profession of mechanical engineering. The work commences with an extended introduction of the principles of Kinnematics, and is continued in three chapters; Chapter I. treating journals, shafting, couplings, and bearings; Chapter II., gearing, and Chapter III., rods and their guides. Plain engravings are used wherever they will help to make the subject clearer. This volume is complete in itself, so far as it relates to the subjects treated, and no library of mechanical works is complete without it. The price at which the book is sold is $5.

THE PAPER MILL DIRECTORY OF THE WORLD. A complete catalogue of all the paper and pulp mills on the globe. 1883. Price, $1.00. Published by Clark W. Bryan & Co, Holyoke, Mass.

This directory is very neatly printed and conveniently arranged. It seems to have been compiled with a great deal of labor and painstaking. The number of paper and pulp mills in the world is given as 4,463, of which the German Empire has 1,108, and the United States 1,099. France comes next with 555, followed by Austro-Hungary with 438.

THE DISPOSAL OF SEWAGE BY SUB-SURFACE Irrigation in Suburban Residences. By Edward S. Philbrick, C.E. The *Sanitary Engineer*, 140 William street, New York. Price, 30 cents.

This little book, which is reprinted from the columns of the *Sanitary Engineer*, contains valuable information on the subject treated. The growing evil of the lack of sewage in the country and in the suburbs of large cities, beyond the general sewage system, demands serious attention. Country residences, instead of being found healthful resorts are frequently found more unhealthy than city houses, mainly for the lack of the proper disposal of sewage. The object of this book is to show how proper sewage may be provided, and the necessary work done without the aid of high engineering talent. It is sufficiently illustrated to satisfactorily explain the subject.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(335) W. C. Y., Paterson, N. J., asks: Please tell me how a governor for marine engines should act; that is, should it open the valve suddenly when the screw enters the water and the engine slows down? *A.*—Various attempts have been made to produce a marine governor that should anticipate the change of speed, as by the pitching of the vessel, or the depth of water at the stern, but we are not aware that these attempts have been in any great measure successful. A marine governor should act substantially, like the best governors in use on stationary engines; that is, feel the slightest change in speed and operate instantly to control the flow of steam.

(336) G. P., Woodville, Mass., writes: I have a set of castings for an upright engine, 3″×5″. The steam-ports are ⅜″×1⅛″ and 1 5-16″ apart. What size shall I make the exhaust-port in cylinder, and what size the exhaust cavity in valve? also, how long should the valve be, and what should be its travel? *A.*—You are a little short of room between steam-ports. You can make the exhaust port in cylinder 11-16″×1½″ and the cavity in valve 1¼″×1⅛″, or 1-32″ inside lap; outside lap, ¼″, which will make the length of valve 2 9-16″; travel of valve, 1¼″, which will just open the steam port. If there were more room between steam ports you could get a better proportioned valve.

(337) J. D. S., Newark, N. J., asks: 1. What should be the dimensions of ports in a double yacht engine 3″x4″ to run at 400 revolutions per minute? *A.*—Steam ports 5-16″x2¾″; exhaust port ⅝″x2¾″, will answer very well. 2. What kind of a boiler shall I use? It should stand a 100 lbs. pressure. *A.*—An upright boiler, 3 feet diameter and 4 feet high, made of 5-16″ iron, will do. 3. With such engines and boiler in a nicely-shaped hull, 35 feet length by 6 feet beam, and a screw 24″ diameter, and 26″ pitch, can I get a speed of fifteen miles per hour? *A.*—With a screw of 26″ pitch, turning 400 revolutions per minute, you may get from eight to nine miles per hour.

(338) K. Y. Freeland, Pa., writes: We have a 5″x5″ engine and a 11-horse power vertical boiler. From the boiler up there is 18″ of 2″ pipe, and a reducer from the top of this pipe up to the safety valve, the boiler being tapped 1¼″ and increased for the 2″ pipe. The pipe to the engine is 1½″, 20 feet long. The engine should run 550 revolutions, but we cannot run more than 375 to 400 revolutions, and then cannot do much work because of water in the pipe. Can you suggest any reason for this? *A.*—Without seeing the arrangement we can hardly suggest a reason. Perhaps the trouble is there is too little steam room in the boiler, or perhaps you carry the water too high; but of this, of course, we know nothing. It would be better to have the safety valve connected with the boiler by itself, as it is almost sure to raise water when it blows. Perhaps it may be found advisable to use some sort of a separator to relieve the steam of water. We should advise that you consult a competent engineer, who, from an examination, will be able to locate the difficulty and suggest the remedy.

(339) F. J. E., Goshen, N. Y., writes: A controversy has arisen with reference to the power of an engine. An engine was built 8″x8″ to run 200 revolutions per minute, and sold for a 15-horse power engine. It is now claimed that the engine is only 8-horse power; that the power has been reduced by lagging out the fly-wheel to make it wider, I claim that the fly-wheel has nothing to do with the question. I find the horse-power by multiplying the area of piston in square inches by the steam pressure in lbs., and the piston speed in feet per minute, and dividing by 33,000. In this case the area of piston is 50.26 inches, the steam pressure 60 lbs., and the piston speed 260 8-12 feet per minute. These multiplied together and divided by 33,000 give as a quotient 24. From this I subtract 25 per cent. for friction, leaving the horse power 18. Am I right? *A.*—You are quite right with reference to the fly-wheel, and in calculating the power, but probably make too great an allowance for friction. With reference to the steam pressure, if the boiler pressure is only 60 lbs. you should not multiply by 60, because you do not get 60 lbs. pressure in the cylinder. If 60 lbs. is the mean effective pressure in the cylinder you are right.

(340) H. F. H., New York, writes: I have in charge two tubular boilers 4½x14 feet. We carry 70 lbs. steam pressure, and run an adjustable cut-off engine, 22″x36″, running 78 revolutions. The exhaust from the engine heats three floors, each 60x40 feet. I am about to put in a Korting condenser, by the use of which I will get about 28″ vacuum, thus relieving the engine of all back pressure. Then I will heat the three floors with live steam and return the condensed water to the boiler by means of a Pratt trap. I will reduce the pressure of steam used in heating to 7 lbs., by means of a pressure reducer. I would like to know what the saving will be? *A.*—You can only estimate the saving by a careful consideration of all the conditions, the most important of which are not given. It would be necessary to know the extra back pressure on the engine resulting from heating by exhaust steam, and to estimate from the construction of the engine the probable back pressure when using the condenser. The amount of coal burned and horse-power used should be known. From all the data you can get, you can estimate approximately how much coal will be saved by using the condenser without any reference to heating the building. Then the question is, will the coal saved be more than sufficient to generate the steam to heat the building? In warm weather, when no steam is required for heating, the gain from the condenser will be much greater than in cold weather.

(341) W. B., Cedar Rapids, Iowa, writes, I rode on a locomotive a short time ago, and when the train was running down grade without using steam, the engineer always put the reverse lever in the forward notch. Now I think by keeping the lever well back so that the valve would have short travel, there would be less friction. What do you think about it? *A.*—Running a locomotive without steam with the lever pulled back is destructive of valve seats and injurious to cylinders. Take the case of an engine with cylinders 24″ stroke, cutting off at 6 inches of the stroke. As the piston moves from the point of cut to the point of release, a partial vacuum is formed in the cylinder, and so soon as the valve opens the exhaust, the hot cinder-laden gases from the smoke box rush in to fill up the vacuum in the cylinder. During the return stroke compression begins about 8 inches from the end of the stroke, and as the compression is too great for the valve to hold down, the latter is jerked away off its seat and causes the valve clattering so well known when engines are run hooked up after the steam is shut off. Some cylinder cocks are made so that they will open when a vacuum is in the cylinder, and so prevent the hot gas from being sucked in. Opening the cylinder cocks is a partial remedy for the evil effects liable to result from running empty cylinders close notched, because they admit air to destroy the vacuum, and permit the escape of the air when compression begins, and so prevent the valves from being jerked off the seat. Having to admit air to the cylinders by cocks or relief valves is objectionable because the tendency is to cool the castings which should be kept hot.

BUSINESS SPECIALS

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Match Machinery, F. Chillingworth, New Haven, Ct.

F. VanWinkle, Mech. Engin'r, 22 Cortlandt St., N. Y.

James W. See, Consulting Engineer, Hamilton, O.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass.

Presses & Dies, Ferracute Mach. Co., Bridgeton, N. J.

Improved Tack Machines,
Taunton Cotton and Machine Co., Taunton, Mass.

The latest Improved Match Machinery is made by the White Machine Co., Waterbury, Conn.

Pattern and Brand Letters. Vanderburgh Wells, & Co., corner Fulton and Dutch streets, New York.

Consulting Engineer and Mechanical expert, C. C. Hill, 144 LaSalle street, Chicago, Ill.

Chas. T. Porter, Mechanical Engineer, Tribune Building, (Room 58,) New York City.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

For sale, lathes of best designs from new patterns. George A. Ohl & Co., E. Newark, N. J.

Patents.—Franck D. Johns, Att'y at Law & Solicitor of Patents, 617 Seventh St., Washington, D. C.

Lyman's Gear Chart How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn.

Latest and best books on Steam Engineering. Send stamp for Catalogue. F. Keppy, Bridgeport, Ct.

Wood Engraving done in best manner. Designs furnished. Edward Sears, 48 Beekman St. New York

Foot Power Machinery, for workshop use, sent on trial if desired. W. F. & John Barnes, Rockford, Ill.

Wood Engraving in all its branches. Max G. Wildnauer, formerly N. Orr & Co. 52 John street, New York.

Jack pump and ladder chain machines, 40 to 80 links per minute, direct from coil. The Gaylord, Cross & Speirs Company, Waterbury, Conn.

William J. Baldwin, consulting engineer in Steam Heating and Ventilation. Author of "Steam Heating for Buildings." Office, 96 Fulton st., New York.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

Young men wishing to take a mechanical course or learn the machinist's trade, call or address School of Mechanical Instruction, No. 195 Front street, Worcester, Mass.

The Complete Practical Machinist, $2 50; the Pattern Maker's Assistant. $2.50; Mechanical Drawing Self-taught, $4 00; books for practical machinists. Address, Joshua Rose, Box 3,306, New York City.

BOUND VOLUMES of the AMERICAN MACHINIST for 1880, 1881, and 1882. A limited number of each sent by express for $4 per volume, express charges to be paid by purchaser. AMER. MACHINIST Publishing Co., 96 Fulton st., New York.

Business men furnished stenographers, who are machine operators, without charge for my services. Shorthand taught by mail. Caligraphs sold; special inducements offered; correspondence solicited. W. G. Chaffee, Oswego, N. Y.

"Patent Binder" for the AMERICAN MACHINIST holds 52 weekly issues in good shape. Sent to any address, in the United States, by mail for one dollar. To Canada and foreign countries 75c., the purchaser to pay custom-house duties and express charges. American Machinist Publishing Co., 96 Fulton street, New York.

"HOW TO KEEP BOILERS CLEAN."—A book of seventy-two pages, telling how to prevent scaling, foaming, priming, and burning, with other valuable information, will be sent to any address FREE of postage, by James F. Hotchkiss, 86 John street, New York.

Any of our readers who have complete files of Volumes I. and II. in good condition, bound or unbound, can probably find a purchaser by addressing us, and stating the lowest price they will accept. AMERICAN MACHINIST PUBLISHING COMPANY, 96 Fulton street, New York.

Slide valve working models, $2 each. Full size working drawings for making same, 25 cents. Shows effect of lap, lead, expansion, cushion, &c., at a glance. See notice in this paper, Vol. 6, No. 41, page 9. Will forward on receipt of money or stamps. Also "Useful Hints on Steam," 96 page book, mailed for 15 cents. E. E. Roberts, manufacturer of engines and boilers, 107 Liberty st., N. Y.

Chordal's Letters.—John Wiley & Sons, 15 Astor Place, New York, have now ready a new and enlarged edition, with six additional plates, of Chordal's Letters, comprising the choicest selections from the series of articles entitled "Extracts from Chordal's Letters," which have appeared in the columns of the AMERICAN MACHINIST; with a steel portrait of the author, and upwards of fifty original illustrations by Chas. J. Taylor. One volume 12 mo. of nearly 400 pages, cloth, $2.00. Will be mailed and prepaid on the receipt of the price.

MANUFACTURES

James Monahan is soon to erect a large tin-ware factory in Chicago.

The Bethlehem (Pa.) Electric Light Company will erect a 24x37-foot brick shop.

The Gardner Governor Company, of Quincy, Ill., received the first award at the St. Louis Fair.

J. L. Perry & Co, Berlin, Wis., have recently completed extensive additions to their machine shops.

Keokuk, Ia., expects to have a new sewing machine factory, the company having $160,000 capital.

The Oil City Boiler Works, Oil City, Pa., have recently built a large addition to their extensive plant.

A company has been organized to start a factory and machine shop at Calera, Ala. Work has commenced.

The Sharon (Pa.) Board of Improvements is offering free sites to manufacturers to locate new industries in that town.

Walker Bros. & Co., 2227 Wood street, Philadelphia, will erect a second story addition to their machine shop 30x100 feet.

Montague & White are to build a 21x160-foot three-story addition to their factory at Hope and Berks streets, Philadelphia.

The Miltimore Car Wheel Company have ordered a 350-horse power engine, also a lot of machinery for their new shops at Garfield, Ill.

The Dennison Manufacturing Company (tags) are about to erect a three-story brick factory 42x80 feet, at 43 & 45 Vale street, Boston.

Joshua S. White is erecting a new building for a foundry in Pawtucket, R. I. It is to be 150x40 feet in size, and 19 feet high to the eaves.

The Sharps Rifle Factory building, Bridgeport, Ct., will be occupied by the Annsville Wire Mills, recently burned out, near Peekskill, N. Y.

The Lowell (Mass.) Machine Shop, which is one of the largest manufactories of textile machines in this country, is running on three-quarters time.

Robert Steinhardt is about to erect a three-story brick manufactory 24x80 feet, at Eleventh avenue and Thirty-seventh st., New York, to cost $10,000.

Belcher & Taylor are making two additions to their Chicopee, Mass., Works, one 100x15 and one 70x30. They manufacture agricultural implements.

The Morden Frog and Crossing Company, of Chicago, have their new works at South Chicago complete, and new machinery up, and will work with 200 hands.

Nathan & Dreyfus, Liberty street, New York, have got out a new locomotive guide-cup, the feeding being done automatically by the suction of the cross-head,

The John Trageser Copper Works, 447 West Twenty-sixth street, New York, will erect a new five-story brick factory, to cost $20,000, at 455 & 457 West Twenty-sixth street.

The Jobbers' Manufacturing Company will erect new shops at Aurora, Ill., to build water-wheels and special machinery. Some of the shops will be ready for work next spring.

The Wrought Iron Range Company, of St. Louis, recently made a contract with the St. Louis Malleable Iron Company for 1,000 tons of malleable castings, for delivery during 1884.

Books of subscription for the Oxmoor (Ala.) Cotton Mills were opened recently, and during the day 215 shares were taken up. The capital stock will be $50,000, divided into 500 shares.

The Shepard Hardware Company, Buffalo, N. Y., have recently moved into new quarters. The main building of the new works is 550 feet long, 260 feet wide, with wing 45x180 feet, covering over three acres.

Mayo & Sons, woolen manufacturers, at Foxcroft, Me., propose to double the capacity of their works this season by the erection of a new mill 80x45 feet and three stories high. They now employ 70 hands.

The round-house and machine shops of the Chicago and Northwestern Road now building at Tracy, Minn., are nearly completed, and the headquarters of that division will soon be removed to that place from Sleepy Eye.

W. C. Young & Co., Worcester, Mass., have shipped eleven of their hand lathes within ten days to various parts of the country. Mr. Young says more lathes are being sold direct to users and a smaller proportion to the trade.

The Bridgeport Brass Company, Bridgeport, Ct., are erecting a new factory 150x35 feet, three stories, and built of brick. This building is erected to accommodate their increasing business in the manufacture of electric light and telegraph wires.

William Frech, of Chicago, says the *Industrial World*, has orders for 25,000 patent bracing-wheels from a New York concern. He is also building two milling machines, and making a number of new tools, expansion reamers, arbors, and mandrels.

At a meeting of cotton manufacturers at Montreal, an arrangement was agreed upon and a constitution and by-laws drafted by which all mills were to shut down for the space of three or four months, to prevent the country from being flooded with any one class of goods.

Joseph Wangler's Boiler and Sheet Iron Works have been considerably enlarged of late by the erection of a 26x140-foot, two-story addition, the upper floor of which is used as a sheet-iron department and the lower floor as a boiler yard, with new office in front.—*St. Louis Age of Steel.*

The Usher-Savage Iron Company, Lawrence, Kan. was recently incorporated with $40,000 capital, to carry on a general foundry and machine business. Engines, boilers, and flour-mill machinery will be their specialties. Mr. Savage has been carrying on a machine shop in Lawrence for more than a year.

The Havemeyer Sugar Refinery Company have obtained a permit to build a nine-story sugar refinery on Commercial street (Greenpoint), Brooklyn, N. Y. Its cost is to be $60,000, exclusive of machinery. They also have a second permit to build a seven-story sugar refinery at same place, to cost $40,000.

H. N. Nichols & Co. have just started up their new works on the line of the Union Pacific Road, a little beyond the Colorado Iron Works, Denver, Col. They have three very large and fine brick buildings in which they will manufacture the Sharpneck steam stamp and other mining machinery in the future.

The Allen Riveting Machine Company, 304 Broadway, New York, are building one of their new stationary riveters, reaching 72 inches, for McWilliams & Brown, boiler makers, Jersey City, N. J. A new feature of this machine is, throwing pressure automatically against the plates before and during the operation of riveting.

A large cracker factory, belonging to Shaver & Dows, Cedar Rapids, Ia., was totally destroyed by fire lately. Within a few days of the fire the ruins were cleared away and the foundation of a new building laid. The works are now well advanced, and will be equipped with an entire new outfit of machinery of the most approved kind.

The Union Machine Shops, of St. Louis, have lately leased the large three-story building on the northeast corner of Fourth and Almond streets, and, within a short time, will connect it with their works by the erection of another building 25x40 feet and three stories high, giving them a works some 35 feet in width and fronting on Almond street for a distance of over half a block,

The Crosby Steam Gage and Valve Company, Boston, Mass., have issued a very neat and well arranged illustrated catalogue of their special manufactures, embracing adjustable pop-valves, steam pressure gauges, water gauges, the Crosby steam-engine indicator, cylinder lubricators, chime whistles, and other steam engineering appliances. Most of the engravings are new, and illustrate improvements in the goods represented.

Rueben & E. I. Comins have purchased the mill property of the Shaw heirs, near Rochdale, Mass., and are fitting it up for a two-set woolen mill. They are building a new brick picker house 52x30 feet, one story, also new storehouse 30x50 feet. A new 30-inch Hercules water wheel will supply the motive power, and was built by the Holyoke Machine Co. The mill is 56x40 feet, and three stories and basement.—The *Woolen Manufacturer.*

The Warren Woolen Company, of Stafford Springs, Conn., has begun to build a three-story brick mill for making fine worsted yarn. The building will be 60x106 feet in size, with a disengaged tower 80 feet high containing the staircase, and a water tank for fire purposes. The boiler and engine houses, the former 40x16 feet, the latter 32x16 feet, are to be separate from the main building, as is also a drying house about the size of the boiler house. One hundred hands will be employed in the new mill.

The Lidgerwood Manufacturing Company, No. 96 Liberty street, New York, who are the most extensive manufacturers in the country of hoisting machinery, having the largest and most complete works in that line, have wisely determined to be represented in Baltimore by the leading machinery agency house in this city, and hence have placed an agency for their goods with Messrs. Morton, Reed & Co., who are so well and favorably known to the trade of the North and South as to scarcely need any further commendation. The hoisting machinery of all kinds manufactured by the Lidgerwood Company is constructed in the most substantial manner, and is adapted to meet the requirements of all lines of work.—*Baltimore Manufacturers' Record.*

From a description in the *Buffalo* (N.Y.) *Advertiser* we gather the following particulars about the new shops of the John T. Noye Manufacturing Company, now building in that city:

"The plot of land purchased is 630 feet long by 265 feet wide. Spacious works are now being constructed and will be completed by the middle of the winter. The new factory will be a vast improvement on the old one, both as to size (being fully a third larger) and adaptability. A building 42x281 feet is now completed and full of machinery. It will be used after the works are completed as a general machine shop. Adjoining this is an engine-room, 32x32 feet, inclosing a 75-horse power engine. This engine is designed to furnish power for the machine shop only. Immediately east of this is the foundry, a substantial brick structure, 80x120 feet. Attached to the foundry will be the wood-shop, brass foundry, cupola, core-rooms, and a cleaning-room annex, 22x50 feet, and sand-room, 22x46 feet.

"Adjoining the foundry and running parallel to it will be located a large blacksmith shop, while on the lake-view side is a pattern-shop, 42 feet by 132 and three stories high. This building is well advanced. It is the plan to build a large and imposing structure adjoining on the west in the near future for offices, but it will not be undertaken this winter."

"Still further east is the main building of the works. It will be 300 feet long by 50 feet wide, two stories high. The side walls of this structure are well advanced. Independent of this is the engine and boiler house, 16x56, inclosing a 100-horse power engine, which will drive the machinery in the main building."

Machinists' Supplies and Iron.

New York, October 11, 1883.

Sterling Elliott, Newton, Mass., has issued a card notifying customers that he will furnish cutters as thin as 1-16" for use with his cutting-off tool. Extra cutters, thick or thin, will be furnished at 15 cents each, or $1.20 per dozen.

In iron we quote: No. 1 X Foundry, $21 to $21.50; No. 2 X Foundry, $19.50 to $20.50.

Scotch Pig—Coltness, $23.25; Glengarnock, $23; Gartsherrie, $23.50; Summerlee, $22.50, with lower prices to arrive.

Copper—Lake, 15¾c.; other brands, 14¼c. to 14⅜c.

Spelter—Refined, 8c. to 8¼c.; Silesian, 5c. to 5¼c.

Tin in jobbing lots—Banca, 21¾c.; Straits and Malacca, 21c. to 21⅛c.

In boiler plate we quote prices as follows, but the market is weak and concessions freely made on desirable lots.

Tank, 2⅛c. to 2¾c.; Refined, 2¾c. to 2 9-10c.; Shell, 3¼c. to 3⅜c.; Flange, 4¼c. to 4⅜c.; extra Flange and Fire Box, 5¼c. to 5½c.; Siemens Steel Plate, 5½c. to 6c.

WANTED

"Situation and Help" Advertisements, 30 cents for each seven words (one line) each insertion. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue.

Wanted—Several first-class moulders and machinists. Apply, Fort Scott Foundry and Machine Works, Fort Scott, Kansas.

A machinist of ten years' experience on jigs, tools, &c., for milling, drilling, and screw machines, desires a situation. Address J. A. B., this office.

Wanted—An experienced foundry foreman; must be experienced on general jobbing, handling men, &c. Address, stating age, experience, reference, &c., "Melter," care of American Machinist.

Wanted—Parties traveling for other houses and selling to users of steam boilers, to take charge of a small and fast selling article; good references required and the kind of trade solicited. Address "Manufacturer," care Am. Machinist.

First-class mechanical draughtsman and engineer, graduate; able to construct any kind of machinery and buildings (experience in general machinery, tools, sugar, glucose, breweries, ice-machines, &c.) desires situation. Address I. K., 125 Clark street, Room 40, Chicago, Ill.

Wanted—A smart, active young man; one who has had experience in managing help, and is not afraid of work, wanting a situation as foreman, to look after one room in a machine shop, can hear of a good chance by addressing to lock-box 709 Yonkers, N. Y.

Parties (who will make favorable terms) wishing to dispose of part or all of a modern, well-located machinery iron works to a well-known, thoroughly-posted, reliable, and experienced man, who can command large trade. Address, with particulars, "Construction," care of American Machinist.

An experienced, reliable, business and mechanical man, having splendid record and large acquaintance, wishes to arrange with first-class manufacturers to handle their goods in St. Paul, Chicago, or New York. Address "Manager and Salesman," care of American Machinist.

Wanted, at once—two first-class, experienced, mechanical draughtsmen—experience considered as first qualification. Foreigners who cannot talk and understand English well, please not apply. Address, giving full particulars as to years of practice, character of work done, wages expected, &c., Brown & Sharpe Manufacturing Company, Providence, R. I.

A reliable and competent mechanic desires a situation as superintendent or foreman. Experienced in management of shop and men, designing and constructing tools, fixtures, etc., for the economical manufacture of duplicate, or interchangeable work. Good references. Address, Box 2, American Machinist.

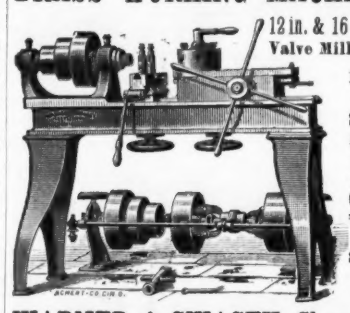
Manufacturing property for sale, 30,000 feet floor space, competing point for four trunk lines railroads, switch from door. Write for terms and description B. W. Payne & Sons, Corning, N. Y.

SPECIAL MACHINERY

Of light and medium weight made complete for use. Machines invented and designed and made to work in any practical purpose.

C. WING, Pattern Maker, Greenfield, Mass.

BRASS WORKING MACHINERY.



12 in. & 16 in. Monitors
Valve Milling Mach's
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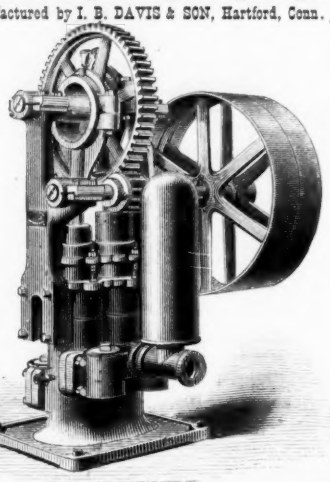

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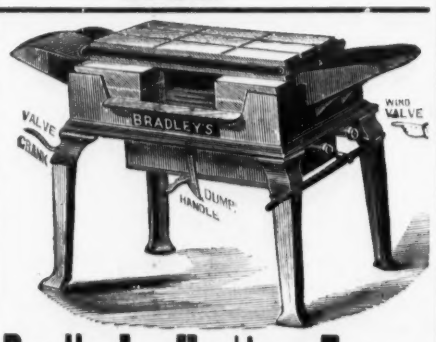

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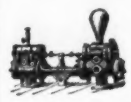

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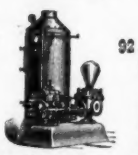

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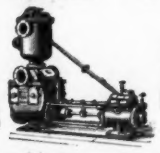

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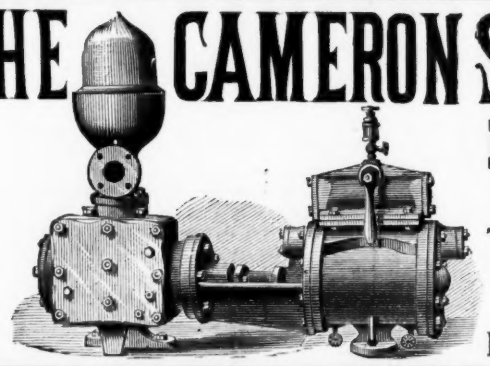

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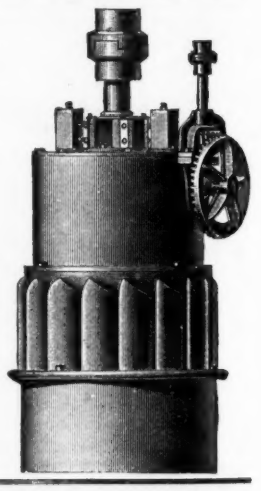

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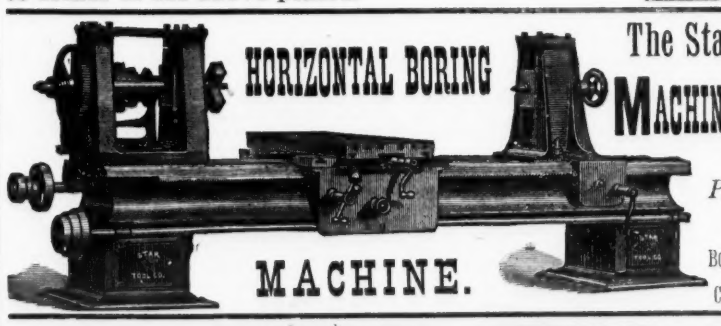

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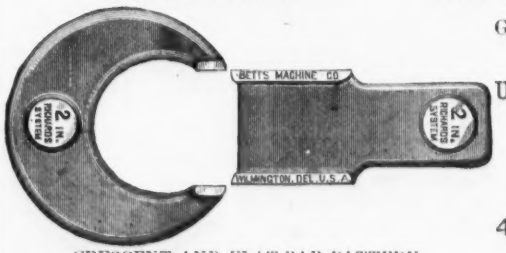

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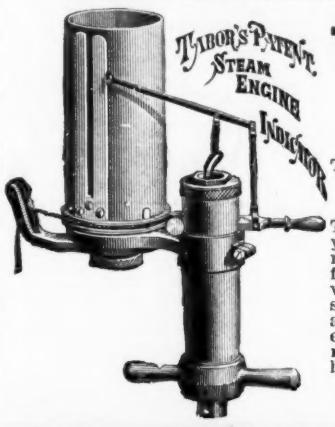

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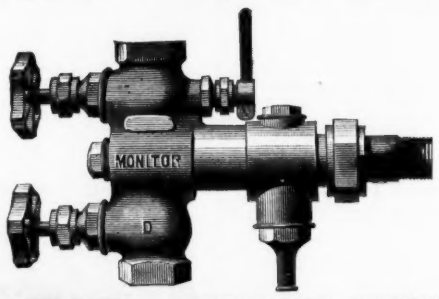

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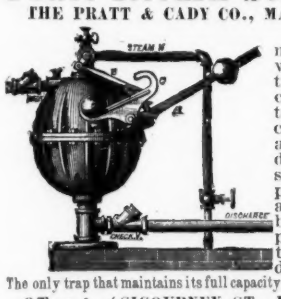

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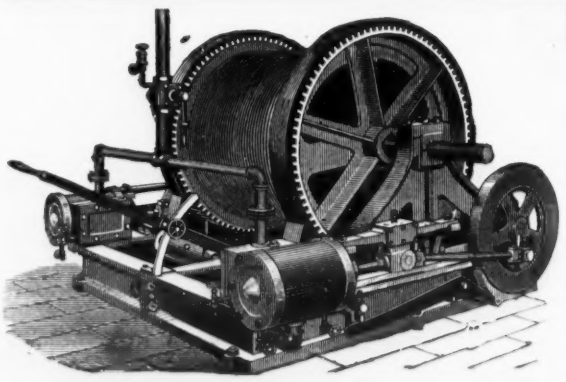

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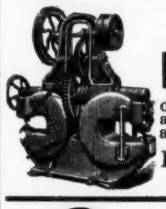

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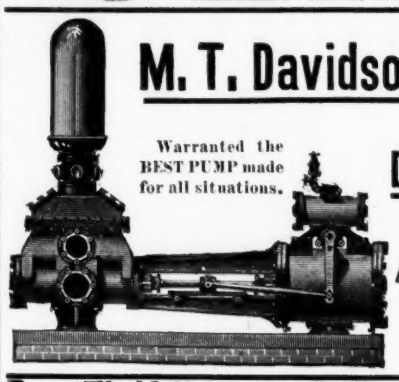

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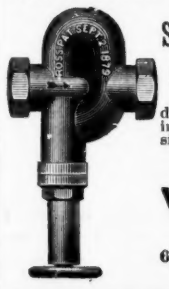

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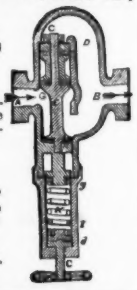

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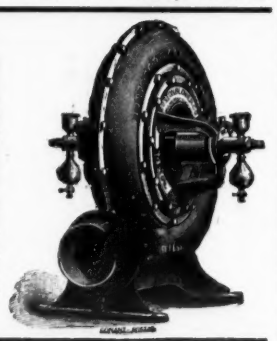

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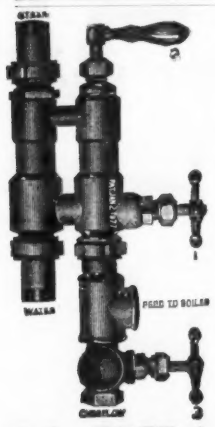

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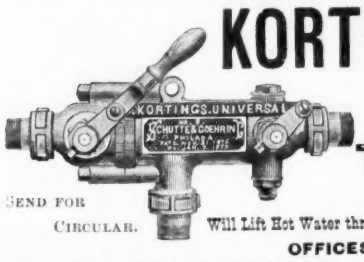

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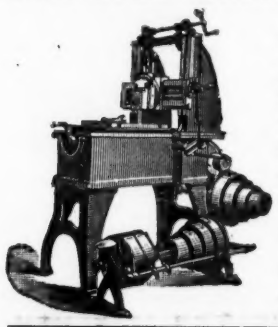

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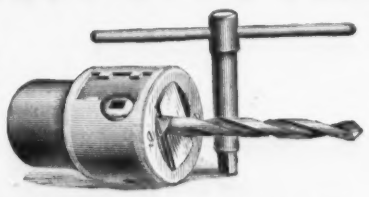

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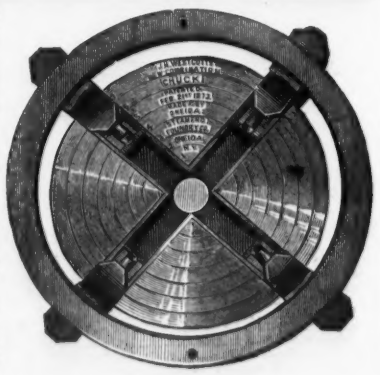

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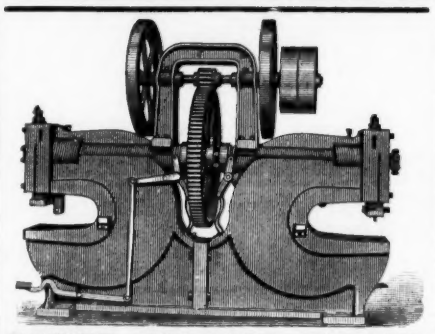

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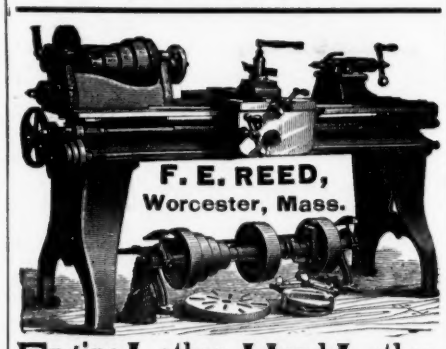

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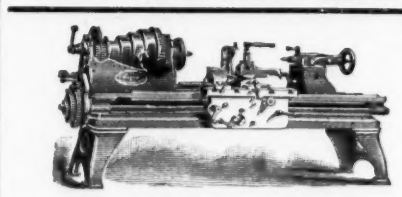

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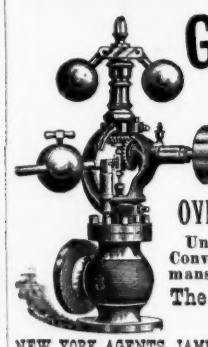

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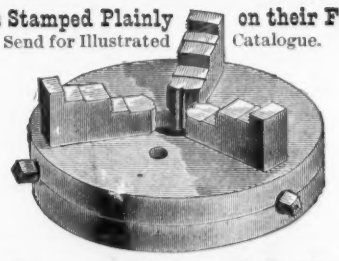

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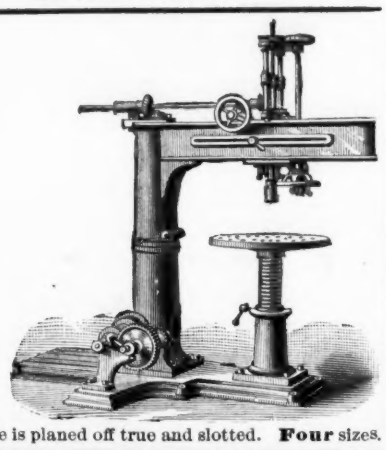

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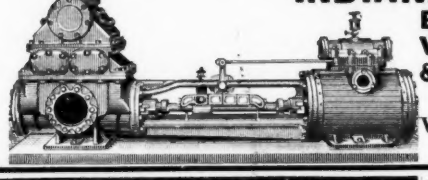

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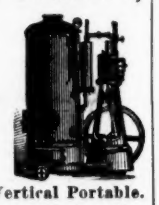

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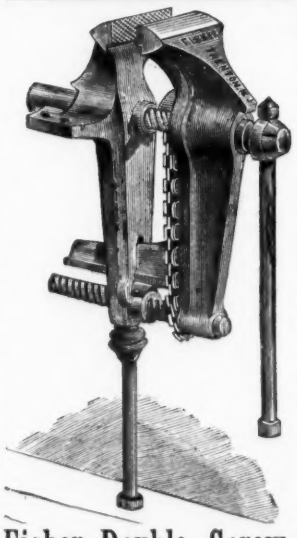

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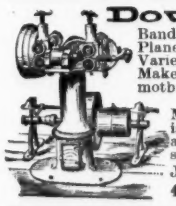

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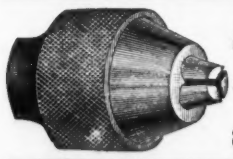

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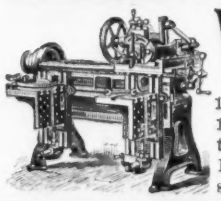

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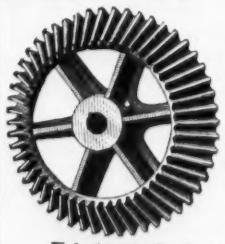

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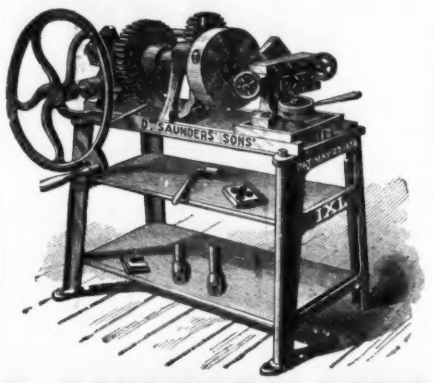

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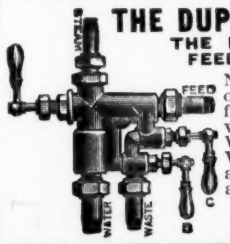

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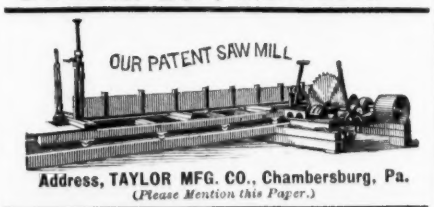

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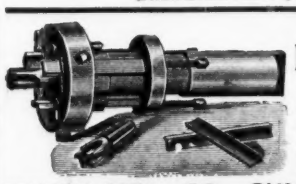

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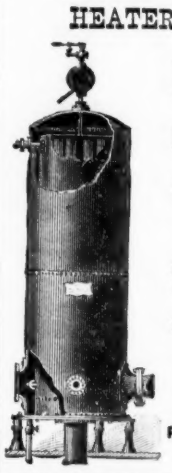

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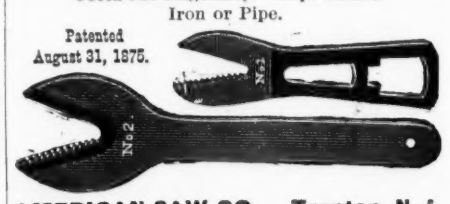

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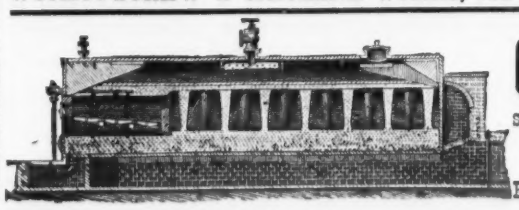

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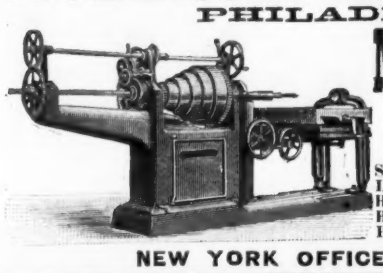

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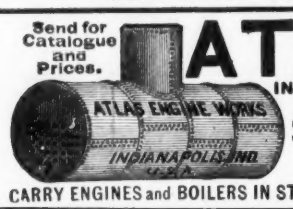

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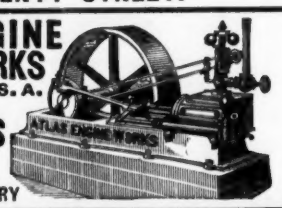

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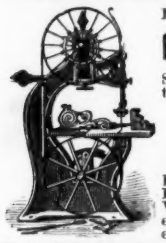

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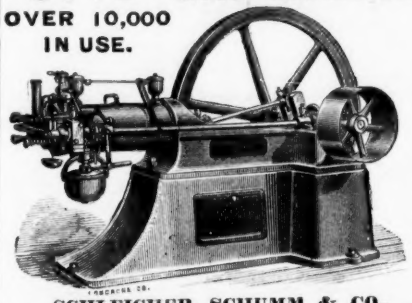

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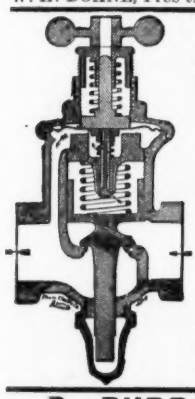

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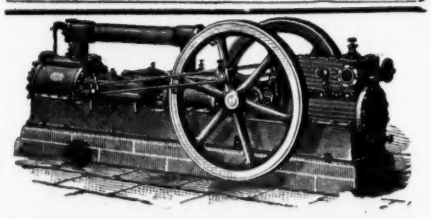

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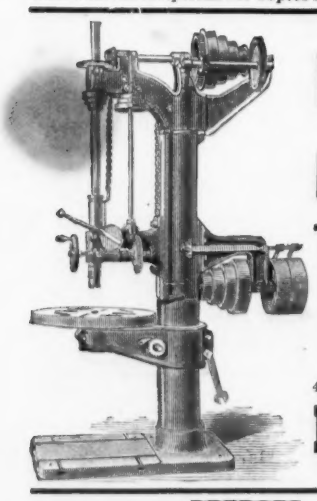

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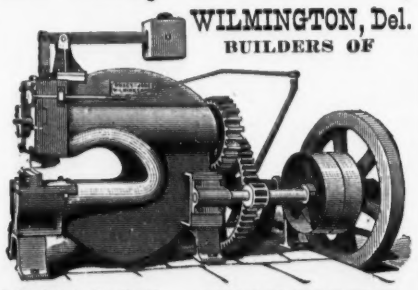

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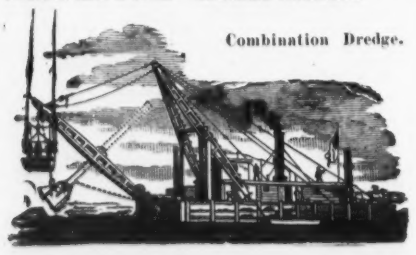

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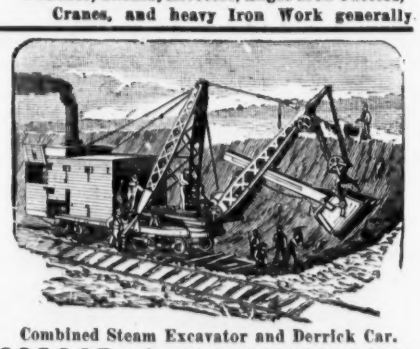

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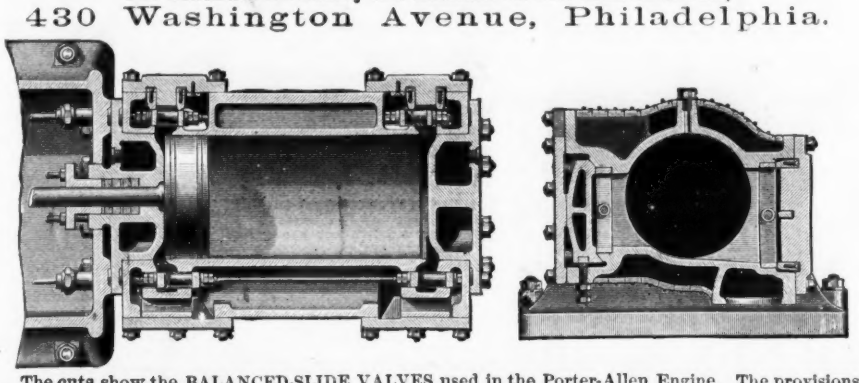

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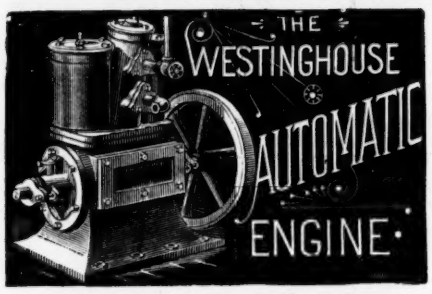

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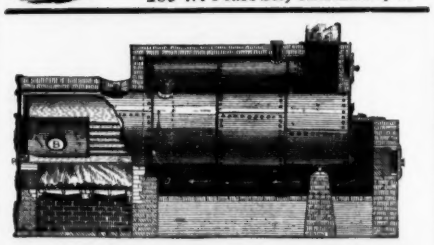

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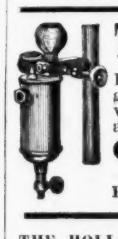

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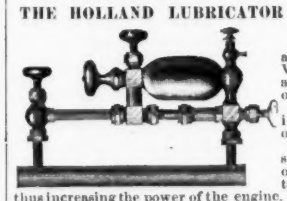

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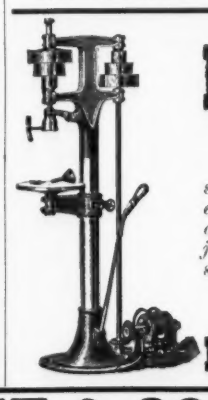

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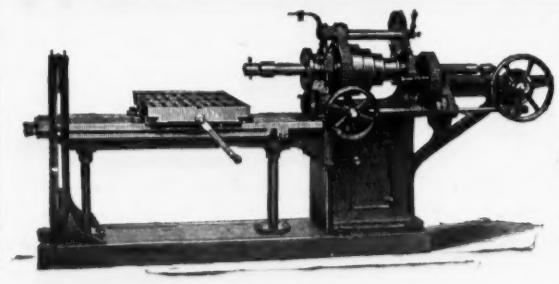

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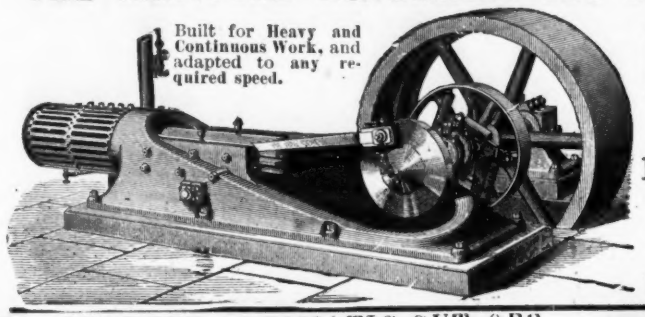

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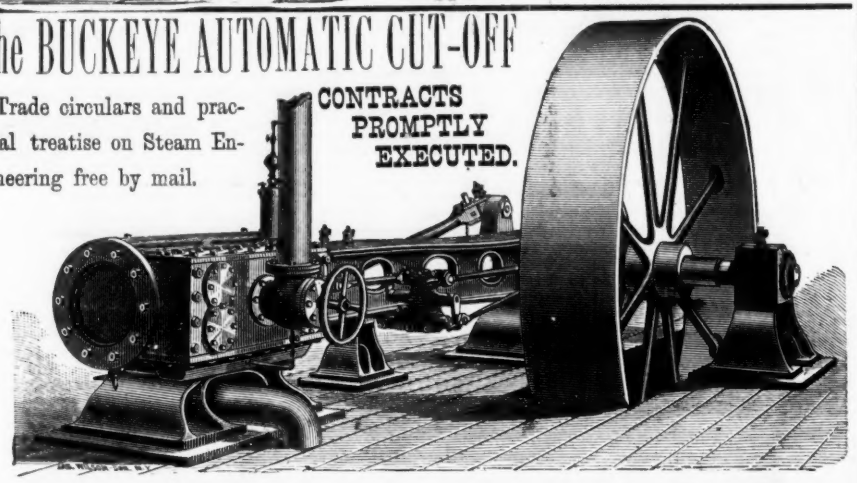

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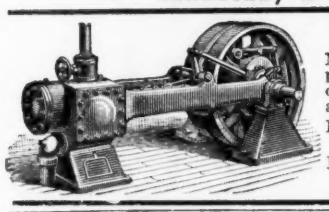

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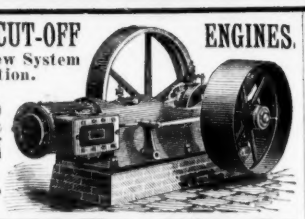

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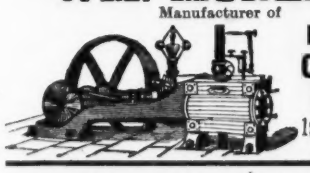

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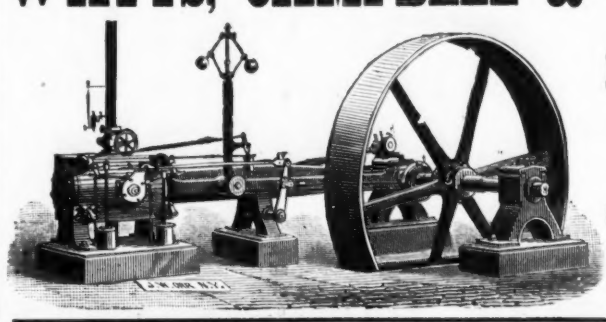

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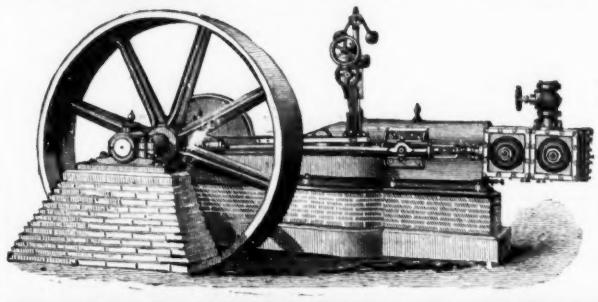

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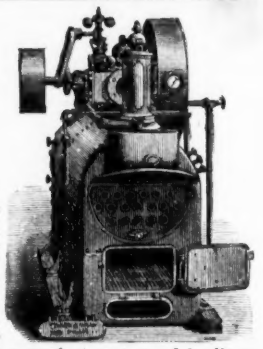

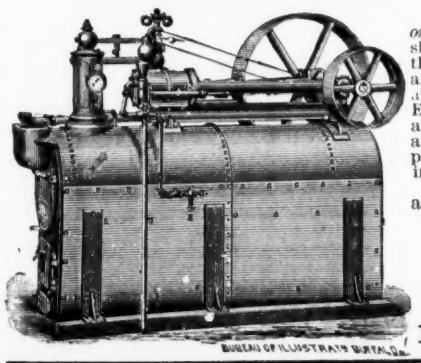

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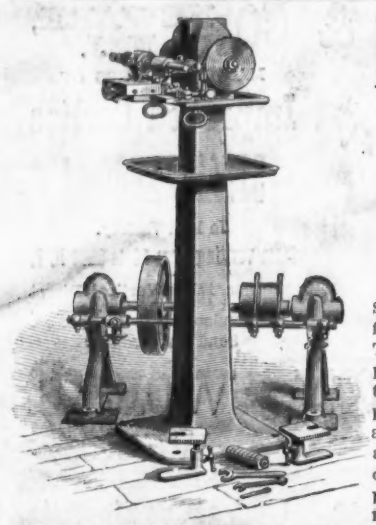

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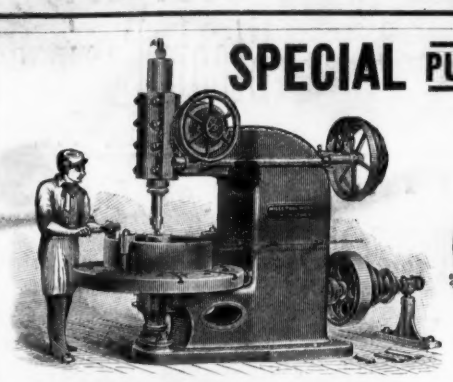

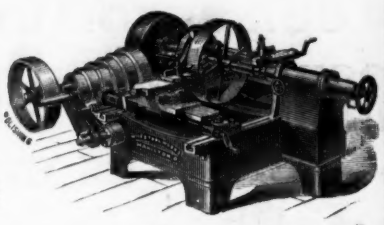

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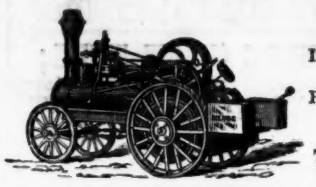

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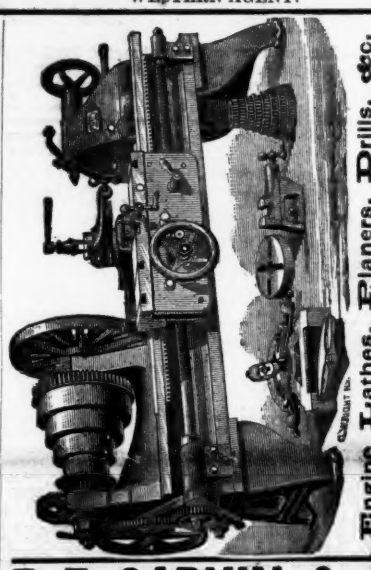

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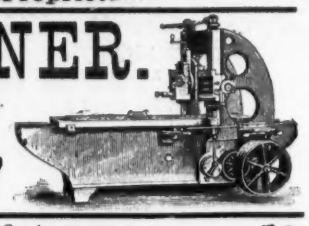

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